Anton Paar

Measure,
what is measurable,
and make measurable
that which is not.

Galileo Galilei (1564-1642)

Instruction Manual

DMA 4100 M
DMA 4500 M
DMA 5000 M

Firmware Version: V2.21

Instruction Manual

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DMA 4500 M
DMA 5000 M

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1 About the Instruction Manual

This instruction manual informs you about the installation and the safe handling and use of the product. Pay special attention to the safety instructions and warnings in the manual and on the product.

The instruction manual is a part of the product. Keep this instruction manual for the complete working life of the product and make sure it is easily accessible to all people involved with the product. If you receive any additions or revisions to this instruction manual from Anton Paar GmbH, these must be treated as part of the instruction manual.

Conventions for safety messages

The following conventions for safety messages are used in this instruction manual:

DANGER
Danger indicates a hazardous situation which, if not avoided, will result in death or serious injury.

WARNING
Warning indicates a hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION
Caution indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

NOTICE
Notice indicates a situation which, if not avoided, could result in damage to property.

TIP *Tip gives extra information about the situation at hand.*

Typographical conventions

The following typographical conventions are used in this instruction manual:

Convention	Description
<key>	The names of keys and buttons are written inside angle brackets.
"Menu Level 1 > Menu Level 2"	Menu paths are written in bold, inside straight quotation marks. The menu levels are connected using a closing angle bracket.

2 Safety Instructions

Liability

- Read the instruction manual at hand before using DMA 4100/4500/5000 M.
- Make sure that this instruction manual is easily accessible to all personnel involved with the instrument.
- Follow all hints and instructions contained in this instruction manual to ensure the correct use and safe functioning of DMA 4100/4500/5000 M.
- The instruction manual at hand does not claim to address all safety issues associated with the use of the instrument and samples. It is your responsibility to establish health and safety practices and determine the applicability of regulatory limitations.
- Anton Paar GmbH only warrants the proper functioning of DMA 4100/4500/5000 M if no adjustments have been made to the mechanics, electronics, and firmware.
- Only use DMA 4100/4500/5000 M for the purpose described in this instruction manual. Anton Paar GmbH is not liable for damages caused by incorrect use of DMA 4100/4500/5000 M.
- The results delivered by DMA 4100/4500/5000 M not only depend on the correct functioning of the instrument, but also on various other factors. We therefore recommend you have the results checked (e.g. plausibility tested) by skilled personnel before consequential actions are taken based on the results.

Installation and use

- DMA 4100/4500/5000 M is **not** an explosion-proof instrument and therefore must not be operated in areas with risk of explosion.

- The installation procedure shall only be carried out by authorized personnel who are familiar with the installation instructions.
- Do not use any accessories or wearing parts other than those supplied or approved by Anton Paar GmbH.
- Make sure all operators are trained to use the instrument safely and correctly before starting any applicable operations.
- In case of damage or malfunction, do not continue operating DMA 4100/ 4500/5000 M. Do not operate the instrument under conditions which could result in damage to goods and/or injuries and loss of life.
- If liquid was spilled over the instrument, disconnect the instrument from the mains. Clean and dry the housing of the instrument. If you have a suspicion that liquid got into the instrument, have the instrument cleaned and checked for electrical safety by a service technician.
- Ensure that spilled liquids cannot get into plug connections or venting slots of electrical equipment.

Moving the instrument

- Make sure that all hoses and the measuring cell are empty before you move or lift DMA 4100/4500/5000 M.
- To move or lift DMA 4100/4500/5000 M, place one hand at the back and grip the ledge at the top. Place the other hand at the front, under the display. There is a hollow for your fingers.
- When carrying the system, keep it close to your body.

Handling of chemicals

- Observe all safety regulations regarding the handling of the samples, cleaning, rinsing and waste liquids (e.g. use of safety glasses, gloves, respiratory protection, exhaustion, etc.).
- Check the chemical resistance of all materials (see Appendix A.2) which come into contact with the sample or cleaning liquid before starting the measurement.
- Make sure that different liquids (samples and cleaning liquids) or gases that come into contact with each other are chemically compatible. They should not react exothermally or produce any solid particles that might stick to the inner wall of the measuring cell.
- Prior to starting a measurement or cleaning procedure, make sure that all parts that come into contact with fluids, especially the measuring cell, the injection adapters, hoses and waste container, are properly connected and in good condition.

- Prior to starting a measurement or cleaning procedure, check the injection adapters for leak tightness (see Chapter 7.2).

Special precautions for flammable chemicals

- Observe and adhere to your national safety regulations for handling the measured samples (e.g. use of safety goggles, gloves, respiratory protection etc.).
- Keep any sources of ignition, like sparks and open flames, at a safe distance from DMA 4100/4500/5000 M.
- Place DMA 4100/4500/5000 M on a laboratory bench with a non-flammable surface preferably made of bricks, ceramics or stoneware.
- Only store the minimum required amount of sample, cleaning agents and other flammable materials near the DMA 4100/4500/5000 M.
- Do not spill sample/cleaning agents or leave their containers uncovered. Immediately remove spilled sample/cleaning agents.
- Make sure that the setup location is sufficiently ventilated. The environment of DMA 4100/4500/5000 M must be kept free of flammable gases and vapors.
- Connect DMA 4100/4500/5000 M to the mains via a safety switch located at a safe distance from the instrument. In an emergency, turn off the power using this switch instead of the power switch on DMA 4100/4500/5000 M.
- Supply a fire extinguisher.
- Ensure the sufficient supervision of DMA 4100/4500/5000 M during operation.

Service and repairs

- Service and repair procedures may only be carried out by authorized personnel or by Anton Paar GmbH.
- Prior to sending DMA 4100/4500/5000 M to your representative or Anton Paar GmbH for repair or service, make sure that all liquids and solvents are completely drained out of the instrument.

Disposal

- Concerning the disposal of DMA 4100/4500/5000 M, observe the legal requirements in your country.

3 The Measuring Principle

Definition of density and specific gravity

The density ρ of a sample is defined as mass divided by volume:

$$\rho = \frac{m}{V}$$

The specific gravity SG is calculated by dividing the density of a sample by the density of pure water at 20 °C:

$$SG = \frac{\rho_{Sample}}{\rho_{Water}}$$

Density and Specific Gravity values are highly temperature-dependent.

The oscillating U-tube method

The sample is introduced into a U-shaped borosilicate glass tube that is being excited to vibrate at its characteristic frequency. The characteristic frequency changes depending on the density of the sample. Through a precise determination of the characteristic frequency and a mathematical conversion, the density of the sample can be measured.

The density is calculated from the quotient of the period of oscillations of the U-tube and the reference oscillator:

$$\text{density} = KA \times Q^2 \times f_1 - KB \times f_2$$

KA, KB...	Apparatus constants
Q	Quotient of the period of oscillation of the U-tube divided by the period of oscillation of the reference oscillator
f_1, f_2	Correction terms for temperature, viscosity and nonlinearity

Concentration measurement

In binary mixtures, the density of the mixture is a function of its composition. Thus, by using density/concentration tables, the density value of a binary mixture can be used to calculate its composition. This is also possible with so-called quasi binary mixtures. These are mixtures containing two major components and some additional components which are present in very small concentrations compared to the two main components. Many decarbonated soft drinks, for example, can be considered to be quasi binary solutions of sugar in water because the concentration of flavors and acids are very small compared to sugar and water. Thus, the sugar concentration can be measured with a density meter.

Note that the accuracy of the concentration measurement depends on the accuracy of the instrument, but also on the slope of the density/concentration correlation. This means, for example, that a density measurement with an accuracy of ±0.00001 g/cm^3 will be converted into an ethanol value with a significantly smaller accuracy of ±0.025 % w/w. The accuracy of some typical concentration measurements is given in Appendix A.1.

4 The Instrument - An Overview

The DMA M series instruments are density and concentration meters that were developed to combine highest precision with easy operation and robust design.

The measurement is based on the oscillating U-tube method which was invented by Dr. Hans Stabinger and Dr. Hans Leopold at the Joanneum Research Institute (Graz, Austria) and first introduced onto the market by Anton Paar in 1967.

Features and Benefits

Accuracy

Your DMA M series instrument is equipped with the world's most advanced digital density measurement technology:

- The period of oscillation of the U-tube is measured by optical pickups.
- Two integrated Pt 100 platinum thermometers together with Peltier elements provide an extremely precise thermostatting of the sample.
- ThermoBalance™: An additional reference oscillator provides long-term stability and enables precise measurements over the whole temperature range of the instrument with only one adjustment at 20 °C.
- Viscosity-related errors are automatically corrected over the full viscosity range by measuring the damping effect of the viscous sample followed by a mathematical correction of the density value.
- In the DMA 5000 M, special adjustments with standards of high viscosity and high density lead to an enhanced precision for samples with high viscosity and high density.

Error detection

A major source of measuring errors when using density meters are gas bubbles in the measuring cell. This issue was addressed by Anton Paar with two new features:

- FillingCheck™: The instrument automatically detects inhomogeneities and gas bubbles in the whole measuring cell by an advanced analysis of its oscillation pattern and generates a warning message in real time for any single measurement.
- U-View™: You can visually inspect the measuring cell using a real-time camera with zoom function (DMA 4500/5000 M).

User interface

The touch screen user interface supports easy and intuitive operation in routine applications as well as in sophisticated scientific research work:

- For the most common applications, 10 measuring methods are predefined. Just select the method fitting your application or create your own methods.
- The density values are automatically converted into concentration values for a large number of factory-programmed substances. You can also program special substances as required.
- Under harsh industrial conditions, operate the DMA M with the set of robust softkeys instead of the touch screen.
- You can operate the DMA M via external keyboard, computer mouse or bar code reader.
- You can connect an external terminal or touch screen (VGA interface).

Data management and safety

The DMA M series offers up-to-date data management and safety features to make your work easier and help you comply with your quality management regulations:

- Print out reports.
- Export your data in the format of your choice (MS Excel, text or PDF).
- Choose between the interfaces: 4 x USB, Ethernet, RS-232, 2 x S-BUS and CAN BUS.
- Use the powerful audit trail function with tamper-proof data export (checksum).
- Rely on full compliance with GLP/GMP and 21 CFR part 11.

Compact and robust design

The tradition of the legendary previous DMA generations is continued in the M series:

- Compact design
- Sealed housing
- Robust housing materials: coated aluminum (top and sides), aluminum (base and back) and Polystyrene/Butadiene (front).

5 Checking the Supplied Parts

DMA 4100/4500/5000 M was tested and packed carefully before shipment. However, damage may occur during transport.

1. Keep the packaging material (box, foam piece, transport protection) for possible returns and further questions from the transport and insurance company.
2. Check the delivery for completion by comparing the supplied parts to those noted in Table 5.1.
3. If a part is missing, contact your Anton Paar representative.
4. If a part is damaged, contact the transport company and your Anton Paar representative.

Table 5.1: Standard parts

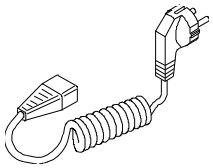
Symbol	Pcs.	Article Description	Mat. No.
	1	DMA 4100 M DMA 4500 M DMA 5000 M	45498 45499 45500
	1	Power cord Europe USA UK Thailand	 65146 52656 61865 79730
	1	Instruction manual English German	 80812 87090

Table 5.1: Standard parts

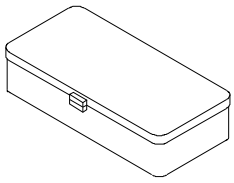
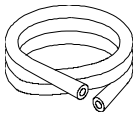
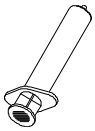
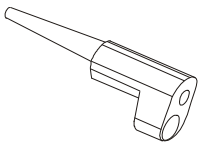
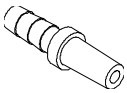
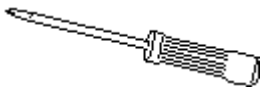
Symbol	Pcs.	Article Description	Mat. No.
	1	Density standard "ultra-pure water" 5x10 mL with certificate	96044
	1	Accessory kit	70248
	2 m	Hose 3 x 5 mm silicone (transparent)	50814
	7	Syringe 2 mL Luer	51974
	2	Injection adapter Luer	12225
	2	Male Luer plug PTFE	63865
	2	Adapter Luer cone	63863
	1	Screwdriver	75030
	1	Waste vessel	6210

Table 5.2: Optional parts

Article Description	Mat. No.
Data handling	
Keyboard German USB	80809
Keyboard USA USB	80807
POS printer RS-232C incl. cable 9600N81	44737
Printer Epson TM-U220D for DMA M	93362
RS-232 connection cable 9 pin 3 m	70429
Gender changer DB9M/DB9M	302592
Automatization	
Sample changer Xsample 122	46534
Sample filling unit Xsample 22	81340
Sample changer Xsample 452	46535
Filling and rinsing unit Xsample 352	81338
Sample handling unit Xsample 52	81339
Heated sample changer Xsample 452 H	84806
Heated filling and rinsing unit Xsample 352 H	84808
Protection	
Protecting cover for keyboard	13350
Protection cap for USB interfaces	81168
Protection foils for touch screen (3 pcs.)	81402
Protective cover front (3 pcs.)	88856
Special funnel protection	82448
Special application accessories	
Aerosol adapter	74650
Cooling kit DMA M	80810
Drying cartridge (with beaded ruby gel)	65085
Heating attachment for DMA M	83161
Syringes	
Syringe 2 mL Luer (1 pc.)	51974
Syringes 2 mL Luer (10 pcs.)	58802
Syringes 2 mL Luer (1000 pcs.)	66399
Syringes 5 mL Luer (100 pcs.)	6772

6 Functional Components

6.1 View of the Front and Right Side

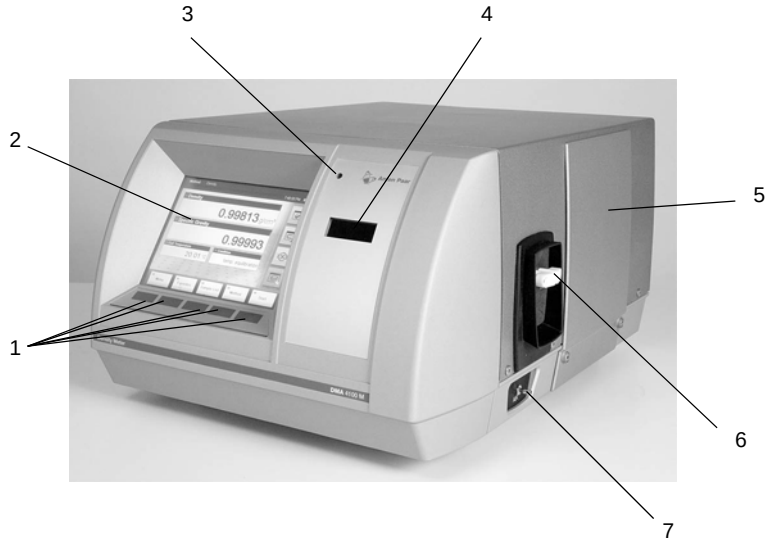


Fig. 6 - 1 View of the front and right side of DMA 4100 M

1 ... Softkeys
2 ... Color TFT touch screen
3 ... Power on LED
4 ... Inspection window for the measuring cell (DMA 4100 M only)
5 ... Xsample slot cover plate
6 ... Sample inlet and outlet
7 ... Air pump outlet

6.2 View of the Left Side

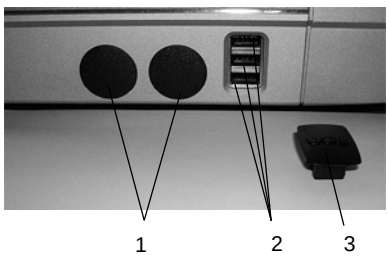


Fig. 6 - 2 View of the left side

1 ... Blind covers for inlet and outlet of the optional cooling kit
2 ... USB interfaces
3 ... Protection cover for the USB interfaces

6.3 Rear View

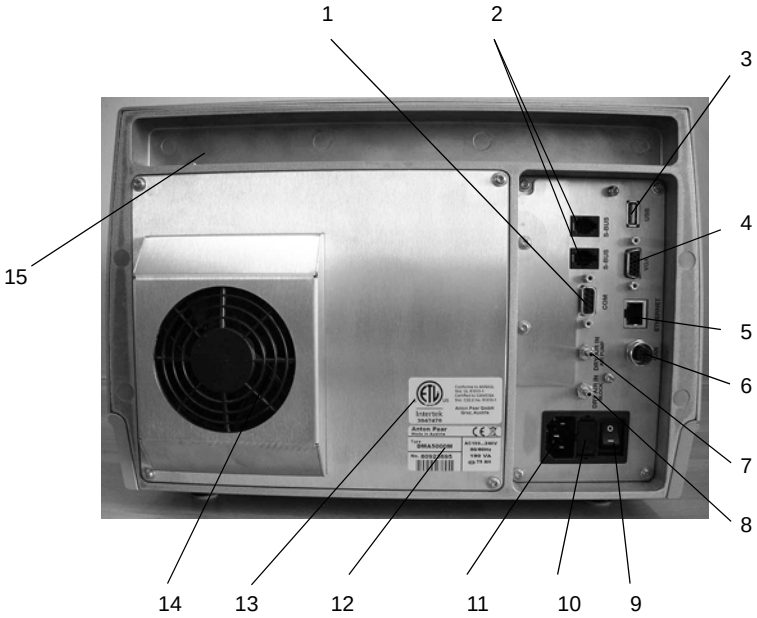


Fig. 6 - 3 Rear view

1 ... RS-232 interface (COM)
2 ... S-BUS interfaces
3 ... USB interface
4 ... VGA interface
5 ... Ethernet interface
6 ... CAN interface
7 ... "DRY AIR IN AIR PUMP" connector
8 ... "DRY AIR IN BLOCK" connector
9 ... Power switch
10 ... Fuse holder
11 ... Power inlet
12 ... Type plate with serial number
13 ... UL test mark
14 ... Fan
15 ... Carrying ledge

6.4 Operating Elements of the Main Screen

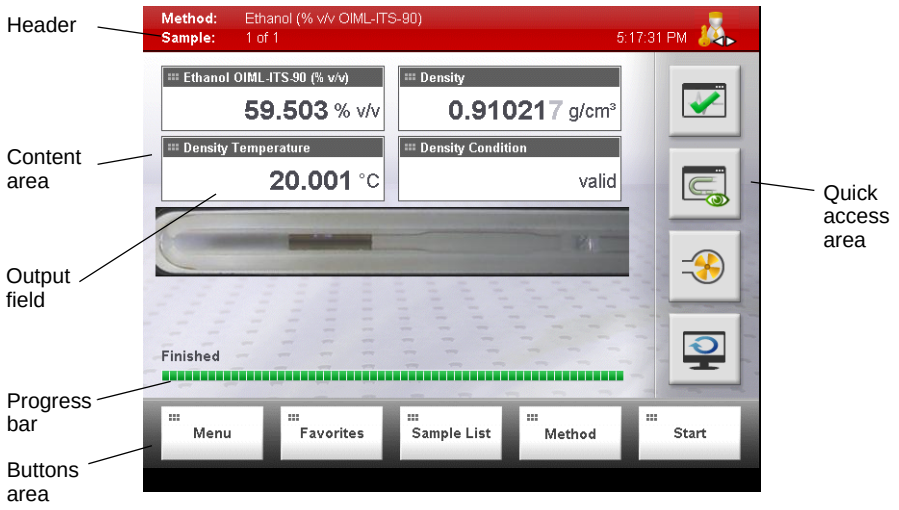


Fig. 6 - 4 Main screen example

Header

In the left part of the header, you find the name of the currently active method and the sample number.

On the right side of the header you find a clock and the user indicator. The user indicator indicates the kind of user that is currently logged on (see Chapter 10.4).

Content area

In the content area, the measuring values are displayed in small, medium or large output fields. The layout of the content area is defined in the settings of the current method and can be adapted according to your needs.

The progress bar at the bottom of the content area indicates whether the instrument is currently measuring or whether a measurement was finished.

Buttons area

The buttons in this area have the following functions:

<Menu>	To open the main menu.
<Favorites>	To open the favorites list.
<Quick Settings>	To open the quick settings list. Only available in the "No Sample List" mode instead of the <Sample List> button.
<Sample List>	To open the current sample list.
<Method>	To open the method list and select a method.
<Start>	To start a measurement.
<Stop>	To stop and abort a measurement.

Quick access buttons

	To open the diagnosis list. The general instrument status as well as all measuring errors that have occurred during the measurements of the currently active sample list are described in this list. The button changes its appearance depending on the current error status: With green check: The general instrument status and the error status of all measured samples of the current sample list are OK. With yellow warning sign: • The instrument (or system) has a minor problem (e.g. an air or water check is overdue, there is a printer problem etc.). • One or more samples of the currently active sample list had a filling error. With red lightning sign: • The instrument (or system) has a major problem that needs to be fixed before you continue with measurements (e.g. sample changer is blocked). • One or more samples of the current sample list could not be measured (e.g. measuring cell is partly empty so that it cannot oscillate). To reset the diagnosis button to the green check, confirm all error messages by tapping on the <X> button on the right side of the message. The diagnosis button will also be reset to the green check symbol if you delete the currently active sample list (see Chapter 13.3).
	U-View™: To open the live camera view of the measuring cell (DMA 4500/5000 M only).
 	To start/stop the air pump. The air pump is off. The air pump is on.
 	To unfreeze the screen after a finished measurement. The screen is frozen. The screen is unfrozen.

Monitor mode

If you have not started a measurement yet, or if you have terminated a measurement by tapping <Stop>, the instrument is in the monitor mode and shows a continuous reading of the current measuring values.

Measuring mode

If you have started a measurement, the continuous measuring values are shown until the measurement is finished. The final values are frozen until the next measurement is started. To unfreeze the screen, tap the button.

6.5 Operating Elements of the Menu Screen

To access the menu, tap <Menu> in the main screen.

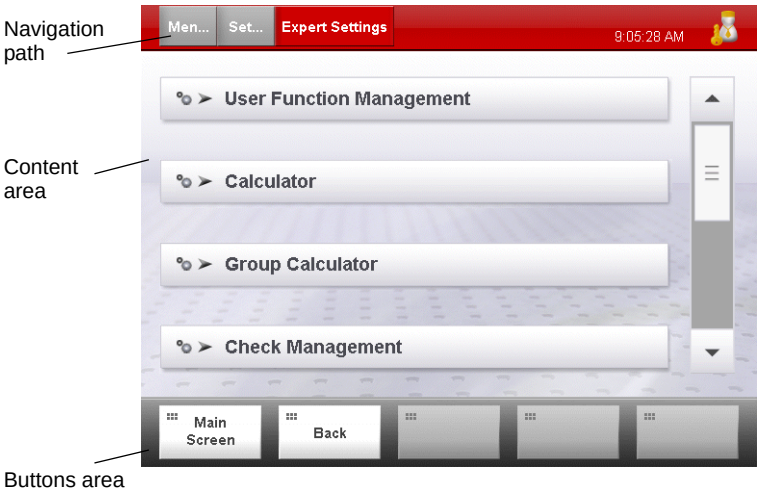


Fig. 6 - 5 Menu screen example

Header

On the left side of the header, you find the navigation path to your current position in the menu. You can go back to any menu position in your current path by directly tapping on the respective box of the navigation path.

Content area

In the content area, you find the menu options of the current menu level and the menu dialogs.

Buttons area

The buttons at the bottom of the screen have different functions depending on the current menu or dialog.

7 Installing the Instrument

To install the instrument, put it on a bench, mount injection adapters and hoses and connect the instrument to the mains. Define general instrument settings and perform an air/water check to check the validity of the factory adjustment.

For the installation of an Xsample filling module, see the respective instruction manual.

7.1 The Right Place

The installation conditions for DMA 4100/4500/5000 M shall correspond to conditions in a typical laboratory.

WARNING
Using hazardous or flammable chemicals as samples or cleaning liquids could destroy the instrument and cause serious injuries when not taking special precautions into account.

- See the section "Special precautions for flammable chemicals" in Chapter 2 for information about a suitable installation place.

To guarantee temperature stability, do not place DMA 4100/4500/5000 M:

- near a heater
- near an air conditioner
- at a vibrating surface or close to vibrating equipment
- in direct sunlight.

NOTICE

- Ensure that the power plug and the power switch are always easily accessible so that the instrument can easily be disconnected from the mains at any time.
- A strong built-in cooling fan dissipates heat through the bottom and the rear of DMA 4100/4500/5000 M. Ensure that the airflow is not blocked and assure a minimum distance of 10 cm (3.9 inches) to walls behind and besides the instrument.
- High humidity or a measuring temperature that is significantly below the ambient temperature may lead to condensation within the measuring cells. Install a drying cartridge (see Appendix C.1) to avoid condensation.

7.2 Mounting the Injection Adapters

1. Take two injection adapters Luer with screws from the accessory box.

2. Pull out the black transport plastic plugs from the tip of the injection adapters.

TIP *Keep the black transport plastic plugs for later. They can be used as an injection adapter tool to widen the tips of the adapters in case of leaks.*

Fig. 7 - 1 Mounting the Luer injection adapters

3. Carefully insert the injection adapters into the openings of the adapter holding plate on the right side of the instrument (see Fig. 7 - 1).
4. With moderate force, push the adapters towards the holding plate.
5. Insert the screws through the bore holes of the adapters and screw them cautiously into the adapter holding plate until some resistance against further turning can be felt.

CAUTION

If the screw for fastening the adapter is screwed in too tightly, the density measuring cell may be damaged. Harmful liquids leaking from the instrument may cause injuries.

- Tighten the screw until some resistance against further turning can be felt and then stop to tighten the screw. The gap left between the holding plate and the adapter where the thread of the screw becomes visible is approx. 3 to 8 mm (approx. 0.12 to 0.31 in).

7.3 Checking for Leak Tightness

1. Close one adapter tightly with a male Luer plug.
2. Fill air under moderate pressure through the other adapter using a plastic syringe from the accessory box and wait for a few seconds.
3. Release the plunger of the syringe.

   If the connections are tight, the plunger of the syringe will be slowly pushed back by the pressure in the measuring cell.

If the connections are leaking, the plunger will not move. In this case, repeat the mounting of the adapters.

7.4 Mounting the Hoses

To connect the waste vessel

WARNING

Liquids leaking from the instrument may cause injuries and risk of fire.

- Only use the supplied hose and waste vessel if their materials are resistant to the samples and cleaning liquids that you are going to inject.
- If the supplied materials are not resistant, use other parts made of appropriate material.

1. Cut a piece of approx. 250 mm (10 in) length from the silicone hose contained in the accessory box.
2. Attach an adapter Luer cone (from the accessory box) to one end of the silicone hose and insert it into the rear injection adapter of the DMA M.
3. Insert the other end of the silicone hose into the hole of the closed waste vessel cap.

Fig. 7 - 2 Connecting the waste hose

To connect the silicone hose at the air pump outlet

1. Cut a piece of approx. 250 mm (10 in) length from the silicone hose contained in the accessory box.
2. Attach the silicone hose to the air pump outlet.
3. Attach an adapter Luer cone (from the accessory box) to the other end of the silicone hose.

7.5 Switching the Instrument On/Off

WARNING

High voltage at parts of the instrument can cause serious injuries or death.

- Only connect the instruments to the mains via protective earthing.
- Never connect the instrument to the mains via protective separation or protective insulation.
- Make sure that the non-fused earth conductor of the power cord is connected to earth.

NOTICE

Before switching the instrument on, make sure that the correct line voltage is available (AC 100 to 240 V, 50 to 60 Hz). If large voltage fluctuations are to be expected, we recommend using a constant voltage source (UPS).

1. Connect the power inlet of the DMA M to the mains using the power cord.
2. To switch the instrument on, use the power switch at the rear.

   The green LED on the front side of the DMA M indicates that the power is on.
3. Wait at least 15 minutes for the temperature to stabilize.

   After turning on the power, the instrument needs approx. 15 minutes for temperature equilibration and internal temperature adjustments. During this time "temp. equilibration" is displayed.

NOTICE

Do not turn off the instrument during the night. This allows the measuring cell to achieve long term temperature stability.

4. To switch the instrument off, use the power switch.

7.6 Instrument Settings and First Checks

After installing the hardware, set date and time (see Chapter 10.1.1). To check the validity of the factory adjustment, perform an air check and a water check.

The instrument has a factory adjustment over the whole temperature and viscosity range. However, during transport, the density adjustment can be influenced.

To perform first checks

1. Wait at least 15 minutes after a reboot for the temperature to stabilize.

2. To perform an air check, tap <Menu> and select **"Checks/Adjustments > Checks"** (see Chapter 11.2.2).
3. To perform a water check, tap <Menu> and select **"Checks/Adjustments > Checks"** (see Chapter 11.2.2).
4. Follow the instructions on the screen.
5. If the check results are both OK, the instrument is ready for routine measurements.
6. If any check result is not OK, clean the measuring cell thoroughly and repeat the check.
7. If the check result is still not OK, perform an air/water adjustment (see Chapter 11.3.1).

8 Operating the Instrument

8.1 Input Alternatives

You can:

- Tap the elements on the touch screen.
- Use a computer mouse and click on the elements on the touch screen.
- Use an external keyboard to enter characters.
- Use a bar code reader.
- Use the softkeys below the touch screen.

8.2 Using the External Keyboard

To use buttons

When an external keyboard is connected, you can use the function keys <F1> to <F5> in combination with the <Ctrl> key to operate the five buttons within the buttons area. <F1> corresponds to the leftmost button, <F5> corresponds to the rightmost button.

To operate a button, press <Ctrl> and the corresponding <F> function key at the same time.

To navigate within lists

- To move the cursor one line up or down within the list, press the <↑> or <↓> key on your external keyboard.
- To move the cursor one page up or down, press the <PgUp> or <PgDn> key on your external keyboard.

To exit dialog windows and wizards with/without saving

- To get one menu level higher and save changes, press the <↵> key on your external keyboard.
- To get one menu level higher without saving changes, press the <Esc> key on your external keyboard.
- To navigate to the next wizard step, press <↵> on your external keyboard.

8.3 Using the Touch Screen

In the following parts of this manual, the operation of the instrument is described only for the input option touch screen.

NOTICE

- Only use clean and dry fingers to operate the touch screen.
- Never use any sharp objects.
- Operate the touch screen with gentle fingertip pressure only.

To use buttons

Use the buttons by directly tapping on them.

The buttons at the bottom of the screen can also be activated with the softkeys below them.

To highlight items

To highlight a row in a table or list, directly tap on the row. The highlighted row will change its color from white to dark gray.

Fig. 8 - 1 Example: "Change Quantity" list with "Density" highlighted

To use drop-down boxes

1. Tap on the drop-down box and then highlight an item in the drop-down list.
2. Tap <OK> to select the entry and close the list.

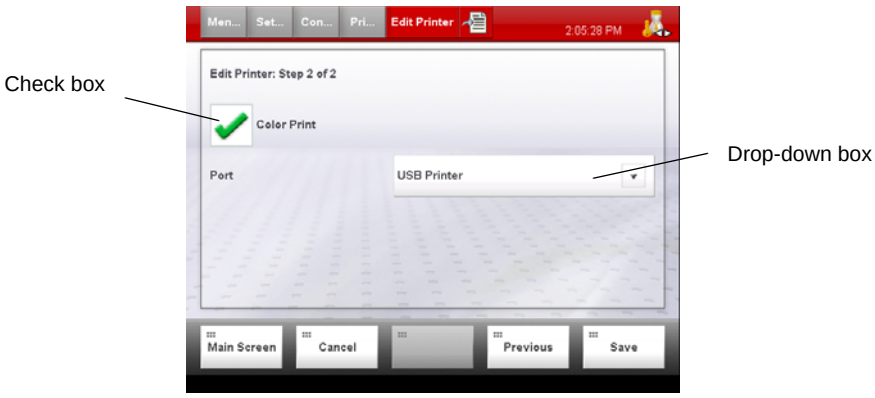


Fig. 8 - 2 Example: Drop-down box and check box in the "Edit Printer" wizard (menu "Setup > Control Panel > Printer Management")

To use check boxes

Tap on the check box to activate or deactivate the desired function (see Fig. 8 - 2).

To use radio buttons

Choose one of the radio buttons to activate one of the available functions.

Fig. 8 - 3 Example: Radio buttons in the "Camera" dialog (menu "Setup > Measurement System Settings > Camera")

To enter characters into an input box or list field

1. There are two ways to open the on-screen keyboard:

   - Tap on the input box or list field twice to open the on-screen keyboard.
   - Tap the "A" symbol within the input box or list field (see Fig. 8 - 4).

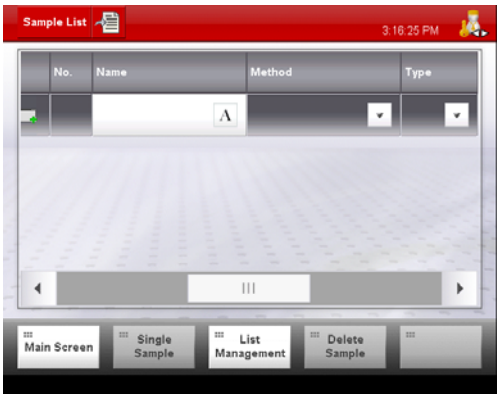


Fig. 8 - 4 Input field of the sample list

2. Enter characters/numbers/special characters by tapping the buttons on the screen and then tap <OK>.

Fig. 8 - 5 On-screen keyboard

The functions of the special buttons are:

	Deletes the character on the left side of the cursor position.
/	Moves the cursor position to the left/to the right.
	Changes to upper case in alphabetic character mode and to special characters in number mode.
123	Changes to the number mode.
abc	Changes to alphabetic character mode.
Alt Gr	Changes to further special characters.
^	For notation of exponential numbers, e.g. to enter 0.025 as 2.5 ^-2 (only number mode).

To exit dialog windows with/without saving

TIP *When a measurement is currently in progress, you cannot save any changes to instrument settings. The <OK> button is deactivated and tapping <Main Screen> quits the dialog without saving the changes.*

You have three options to exit a dialog window:

- To get directly to the main screen, tap <Main Screen> and decide whether you want to save or discard changes in the following pop-up window.
- To get one menu level higher and save changes tap <OK>.
- To get one menu level higher without saving changes tap <Cancel>.

To exit wizards with/without saving

A wizard is a combination of two or more dialog windows. You have three options to exit a wizard:

- To get one level up and save the settings, complete all steps of the wizard and then tap <OK>. To navigate in the wizard steps, use the buttons <Next> and <Previous>.
- To get one menu level up without saving changes, tap <Cancel>.
- To get directly to the main screen without saving, tap <Main Screen> and, in the following dialog, select the option <Yes>.

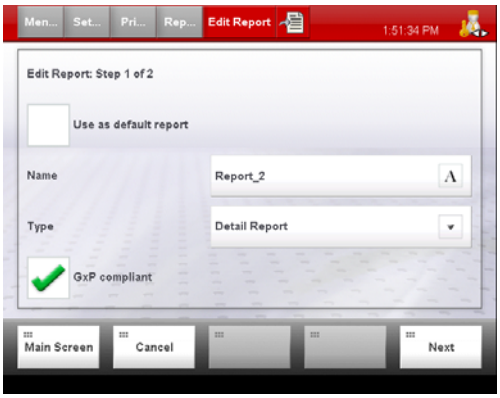


Fig. 8 - 6 "Edit Report" wizard

8.4 Calibrating the Touch Screen

If you have difficulties in hitting the touch screen user elements (buttons, drop-down boxes, etc.), you can calibrate the touch screen. The touch screen sensors will then be adapted to the way you tap on the screen.

1. Tap <Menu> and select **"Setup > Control Panel > Calibrate Touch Screen"**.
2. Follow the instructions on the screen. Use your finger, not a stylus.
3. Tap anywhere on the screen to accept the new calibration.

8.5 Setting the Screen Saver

You can set the time after which the screen saver is automatically activated.

To set the time

1. Tap <Menu> and select **"Setup > Control Panel > Screen Saver"** to open the settings for the screen saver.
2. Use the check box to activate/deactivate the option:
   - Automatically switch off display after ... minutes.
3. Enter a value between 1 and 300 minutes.
4. Tap <OK> to save the changes.

To deactivate the screen saver

There are two ways to deactivate the screen saver:

- Tap the screen or use any other input device (external touch screen, mouse, or keyboard).
- Start a measurement via any interface (Ethernet or RS-232).

8.6 Activating/Deactivating the Feedback Beeps

If both feedback beep functions are activated, the instrument beeps upon every successful touch screen or softkey action, mouse click and bar code reader input as well as after the completion of a measurement.

1. Tap <Menu> and select **"Setup > Control Panel > Feedback Beeps"**.
2. Activate/deactivate the feedback beep option for beeping when a screen item or key is touched.
3. Activate/deactivate the feedback beep option for beeping when a measurement was completed.
4. Tap <OK>.

8.7 Logging On/Off

When delivered, the instrument is freely accessible without password.

If user accounts are installed and passwords set, you may have to pass a logon procedure after switching on the instrument.

To log on

1. Tap on the user indicator on the right side of the header of the main screen to open the "Logon" dialog.

2. Select your "User name", enter your "Password" and tap <OK>.

NOTICE
If the instrument is used in the increased security mode, your user account will be deactivated after three failed logon attempts.

To log off

1. Tap on the user indicator on the right side of the header of the main screen to open the "Logon" dialog.
2. Tap <Log off>.

   The user indicator changes its appearance to:

   The instrument finishes the current measurement or measurement series but does not accept any input until someone successfully logs on.

To retrieve a forgotten password

1. Tap the button <Forgot Password> in the "Logon" dialog.
2. Follow the instructions on the screen.

Related topics

Creating, Editing and Deleting User Accounts: Chapter 10.4.2

8.8 Using Favorites

The favorites function enables you to quickly access your favorite menu dialogs directly from the main screen.

You can also use the favorites function to activate your favorite menu dialogs without touching the touch screen by using the softkeys below the touch screen.

The favorites list is the same for all users.

To add a dialog window to the favorites list

1. Open the dialog window via the menu tree.
2. Tap the "Add to Favorites" icon in the header.

To use the favorites list

1. In the main screen, tap <Favorites> to open the favorites list.
2. Highlight a favorite either by tapping on its name or by using <▲> and <▼> and tap <OK>.

To change the sequence of the favorites list

1. Tap <Menu> and select **"Setup > Favorites Management"**.
2. Highlight the list item and use the up/down arrows in the right column to change the position of the list item in the favorites list.
3. Proceed so with all other list items whose position you want to change and tap <OK>.

To rename a favorites list item

1. Tap <Menu> and select **"Setup > Favorites Management"**.
2. Highlight the list item and tap <Rename>.
3. Enter the new favorite name and tap <OK>.

To delete a favorites list item

1. Tap <Menu> and select **"Setup > Favorites Management"**.
2. Highlight the list item and tap <Delete>.

9 Installing Optional Input/Output Devices

In this chapter, you find information about the installation of optional input/output devices. For detailed information on the devices, see the respective manual.

If you are using accessories that are not supplied by Anton Paar, we do not guarantee their functionality and safety.

9.1 External Keyboard, Bar Code Reader, Mouse

To connect the external keyboard, bar code reader and mouse

- Connect the external keyboard and bar code reader (not supplied by Anton Paar) to one of the USB interfaces that are located on the left and rear of the instrument.
- Connect the mouse (not supplied by Anton Paar) to a USB interface.

To use a bar code reader

A bar code reader can be used to fill in input boxes, e.g. sample names or user-defined data fields. In the "Sample List" mode, you can also assign methods to samples by reading the respective bar code (see Appendix H for bar code examples).

Tested bar code readers are Symbol DS6707 or Datalogic Firescan D131.

To deactivate the on-screen keyboard in the sample list

If you activate this function, the on-screen keyboard will not appear when editing the sample list. You can conveniently enter your inputs with an external keyboard or bar code reader.

You can directly enter your settings into the cells and use the tab key of the external keyboard to jump between cells of the sample list.

If you set your bar code reader to conclude the bar codes with a tab character, the cursor will jump into the next cell after reading a bar code.

1. Select the menu **"Setup > Control Panel > Keyboard and Bar Code Settings"** to open the settings for the external keyboard.
2. Use the check box to activate/deactivate the option "Use a bar code scanner to edit the sample list".
3. Tap <OK> to save the changes.

9.2 USB Flash Drive

- Insert a USB flash drive or another USB mass storage device into one of the four USB interfaces that are located on the left and rear of the instrument.

TIP *Some older USB flash drives are formatted in the super floppy way. These are not compatible with your DMA M instrument. USB flash drives formatted in the standard hard disk way are compatible.*

9.3 Printer

You can use an RS-232 printer via RS-232 interface or an office printer (PCL compatible) via USB interface or via local network. After connecting the printer to the instrument, register the printer in the menu **"Setup > Control Panel > Printer Management"**.

For a list of tested printers, refer to "www.anton-paar.com/generation_m-tested-printers".

9.3.1 Connecting a Printer

To connect an RS-232 printer

1. Connect the printer (Mat. No. 44737 or 93362) to the RS-232 interface (COM) of the instrument using the cable that is supplied together with the printer.
2. If you use an RS-232 printer which is not supplied by Anton Paar, set the communication settings on the printer properly (see Appendix A.3).

To connect an office printer (not supplied by Anton Paar) via USB interface

- Connect the printer to a USB interface of the instrument.

To connect an office printer (not supplied by Anton Paar) via local network

You can connect your instrument and a PCL compatible printer (or an Epson Stylus D120) via Ethernet to your local network.

1. Connect the instrument via Ethernet interface to your local network.
2. Tap <Menu> and select **"Setup > Control Panel > Network"**.
3. If your network server has DHCP functionality, activate "Obtain an IP address automatically (DHCP)", then tap <Next> and <OK>.
4. If your network server has no DHCP functionality, deactivate "Obtain an IP address automatically (DHCP)" and enter the correct "IP Address", "Subnet Mask", "Default Gateway", and tap <Next>.

5. Enter the primary and secondary DNS and tap <OK>.

6. Connect the printer to your local network. For details, see the printer instruction manual.

9.3.2 Registering, Editing, Deleting a Printer

You can register up to 5 printers.

To register a new printer or edit a printer

1. Tap <Menu> and select **"Setup > Control Panel > Printer Management"** to open the printer list.

2. Tap <New> to register a new printer or highlight a list item and tap <Edit> to edit a printer.

   The "Edit Printer" wizard opens.

3. For RS-232 printers, perform the following settings:

   - Activate/deactivate the check box "Use as default printer".
   - Enter a "Name" for the printer.
   - Select the adequate printer "Type".

4. Tap <OK>.

5. For USB and network printers, perform the following settings:

   - Activate/deactivate the check box "Use as default printer".
   - Enter a "Name" for the printer.
   - Select the adequate printer "Type".
   - Select the paper "Format".

6. Tap <Next>.

   - Select the "Port".
   - Activate/deactivate the check box "Color Print".
   - For network printers only: Enter the IP address and IP port.

7. Tap <OK>.

To delete a printer

1. Tap <Menu> and select **"Setup > Control Panel > Printer Management"** to open the printer list.

2. Highlight a printer list item and tap <Delete>.

TIP *The standard printer cannot be deleted.*

Related topics

Creating, Editing and Deleting Printer Report Layouts: Chapter 10.2.1
Defining the Result Output: Chapter 12.2.3
Printing and Exporting Results and Other Data: Chapter 15.6

9.4 External Terminal or Data Projector

The external terminal or data projector (not supplied by Anton Paar) has to be capable of delivering a 640 x 480 px resolution in true color (VGA) at minimum 60 Hz.

- Connect the external terminal or data projector to the VGA interface at the rear of the instrument.

9.5 External Touch Screen

The external touch screen (not supplied by Anton Paar) has to be capable of delivering a 640 x 480 px resolution in true color (VGA) at minimum 60 Hz.

Only touch screens from Elo Touch Systems and compatibles are supported. We recommend the model Elo 1715L 17" LCD Desktop Touchmonitor (1000 Series, firmware V1.9 and higher). Only order the external touch screen with IntelliTouch Surface Wave Touch Technology.

- Connect the external touch screen to the VGA interface at the rear and to one of the USB interfaces that are located on the left and rear of the instrument.

TIP *Connect the USB plug via a hub to the DMA M. Otherwise, the touch screen functionality might fail.*

- If necessary, run an auto adjustment routine on the external touch screen. For details, see the touch screen instruction manual.

Calibrating the external touch screen

If you have difficulties in hitting the touch screen user elements (buttons, drop-down boxes, etc.), perform a touch screen calibration.

To calibrate the touch screen

1. Tap <Menu> and select **"Setup > Control Panel > Calibrate External Touch Screen"**.

2. Follow the instructions on the screen. Use your finger, not a stylus.

10 Defining General Settings

10.1 Instrument Settings

These settings are not method-dependent and thus will not change after a change of the current method.

10.1.1 Date and Time

1. Tap <Menu> and select **"Setup > Control Panel > Date and Time"**.
2. Enter the current date and time and tap <OK>.

10.1.2 Regional Settings

1. Tap <Menu> and select **"Setup > Control Panel > Regional Settings"**.
2. Enter the "Language", "Data Format" (for numbers, date and time format, etc.), and the "Keyboard Layout".

   The instrument displays "Are you sure you want change the regional settings? The instrument will reboot to complete this action."
3. Tap <Yes> to install the new settings.

   The instrument reboots.

If the instrument is operated in a language or font you do not understand, proceed as follows:

1. Tap the leftmost button in the main screen (<Menu>).
2. Select the menu item with the symbol (menu **"Setup"**).
3. Select the second menu item (menu **"Setup > Control Panel"**) and again the second menu item (menu **"Setup > Control Panel > Regional Settings"**).
4. Use the drop-down boxes to set the desired language, data format and keyboard layout.
5. Confirm each change with the rightmost button (<OK>) in the buttons area.
6. In the following dialog, tap the right button (<Yes>).

   The instrument reboots.

10.1.3 Input Units

In this menu, you can define the unit for every temperature value which you enter during operation.

1. Tap <Menu> and select **"Setup > Control Panel > Input Units"**.
2. Select the input unit for temperatures and tap <OK>.

10.1.4 Air Pump Settings

You can set the timeout after which the air pump is stopped and the condition on which the air pump is stopped.

1. Tap <Menu> and select **"Setup > Measuring System Settings > Air Pump"**.
2. Use the check box to activate/deactivate the option:
   - Air pump stops automatically when density value is stable.
   - Air pump stops automatically after ... s.

   In case both options are activated and the air density value gets not stable within the period of time that is defined with the second option, the air pump stops nevertheless after this period of time.
3. Tap <OK> to save the changes.

10.1.5 Saving a Camera Picture (DMA 4500/5000 M Only)

You can define when the instrument automatically saves a picture of the measuring cell.

1. Tap <Menu> and select **"Setup > Measuring System Settings > Camera"**.
2. Use the radio buttons to select one of the options:

   Automatically save a picture ...
   - of each measurement
   - only if a measuring error is detected
   - never
3. Tap <OK> to save the changes.

10.1.6 Network

If you connect the instrument to your local network, you can use a network printer for printouts and request the instrument system information and instruction manual via any PC in the network.

1. Tap <Menu> and select **"Setup > Control Panel > Network"**.

2. If your network server has DHCP functionality, activate "Obtain an IP address automatically (DHCP)", then tap <Next> and <OK>.

3. If your network server has no DHCP functionality, deactivate "Obtain an IP address automatically (DHCP)" and enter the correct "IP Address", "Subnet Mask", "Default Gateway", and tap <Next>.

4. Enter the primary and secondary DNS and tap <OK>.

10.1.7 Instrument Name and Location

If you have more than one DMA M and want to easily differentiate between them in printouts, data exports or within your local network (LIMS), you can define instrument names and locations.

1. Tap <Menu> and select **"Setup > Control Panel > Instrument Name and Location"**.

2. Enter the "Instrument Name" and "Instrument Location" and tap <OK>.

10.2 Defining the Printout Settings

You can define the layout of the printer report and if you want an automatic printout. To set the output data for each method, see Chapter 12.2.3.

10.2.1 Creating, Editing and Deleting Printer Report Layouts

You can set up to 10 different report layouts for e.g. different methods, different sample types or for internal or external use. The layouts can be created, edited or deleted.

To create or edit a report

1. Tap <Menu> and select **"Setup > Printout Settings > Report Management"** to open the report list.

2. Tap <New> to create a new report or highlight a list item and tap <Edit>.

   The two-step "Edit Report" wizard opens.

3. Perform the following settings:

   - Activate/deactivate the check box "Use as default report".
   - Enter a report "Name".
   - Select the report "Type" "List" or "Detail".

   List reports contain several measurement results in a table.

   Detail reports contain one detailed measurement result per page.

   - Activate/deactivate the "GxP compliant" function.

4. Tap <Next> and perform the following settings:

   - Define the paper format (portrait or landscape).
   - Activate/deactivate the check box "Print Camera Image".

5. Tap <Save>.

To delete a report

1. Tap <Menu> and select **"Setup > Printout Settings > Report Management"** to open the report list.

2. Highlight a list item.

3. Tap <Delete>.

10.2.2 Defining Header and Background of the Printer Report

You can import logos via USB flash drive and use them as header or background logo in the printer report. You can also define an address which will be printed in the header of the printer report.

To be recognized by the instrument and fit into the document layout, the logo graphic files have to:

- have the extension .jpg or .bmp.
- be located in the root directory of the USB flash drive.
- have a maximum size of 400 x 200 px (header logo).

To import logos

1. Tap <Menu> and select **"Setup > Printout Settings > Import Logos"**.

2. Use the drop-down list "Drive" to select the connected USB flash drive.

3. Use the drop-down list "File Name" to select the correct file.

4. Use the drop-down list "Place" to define the position of the file in the internal logo list.

5. Tap <Import> to load the file from your USB flash drive into the instrument.

To select logos

You can select a logo for the report header and a second logo for the report background.

1. Tap <Menu> and select **"Setup > Printout Settings > Select Logos"**.

2. Use the two drop-down boxes to select a logo for the header and a second logo for the background.

3. Tap <OK> to save the changes.

To enter name and address for the header

1. Tap <Menu> and select **"Setup > Printout Settings > Name and Address"**.

2. Enter the name and address and tap <OK>.

10.2.3 Activating/Deactivating an Automatic Printout

1. Tap <Menu> and select **"Setup > Printout Settings > Automatic Printout"**.

2. Use the drop-down box "Frequency" to define if you want to have an automatic printout after each sample or if you do not want to have an automatic printout.

3. Use the drop-down box "Printer" to define on which printer you want to have the print reports.

4. Use the drop-down box "Report" to select the report layout.

   The "list report" layout type cannot be selected for the automatic printout.

5. Tap <OK> to save the changes.

Related topics

Registering, Editing, Deleting a Printer: Chapter 9.3.2
Defining the Result Output: Chapter 12.2.3
Printing and Exporting Results and Other Data: Chapter 15.6

10.3 Setting Sample List Options

In the **"Sample List"** menu, you can:

- Select the sample list mode.

- Define automatic sample name additions before and after the sample name. These additions will be added to each sample name after the measurement of the sample was finished. You can compose the additions out of a fixed part and an additional data field (date and time, user name, sample number, etc.).

- Activate up to three user-defined data fields and give names for the fields. In these fields, you can assign special types of information of your choice to your samples. Typical examples are a filling line number, tank number or batch identification. For each data field that you define, an extra column will be added to the sample list.

- Define mandatory data fields. The measurement can only be started after filling in the mandatory data fields. If mandatory data fields are not completed in the sample list, these fields will be prompted again for completion after the start of the measurement.

To set sample list mode and automatic sample name

1. Tap <Menu> and select **"Setup > Measuring System Settings > Sample List > Sample List / Sample Settings"**.
2. Select the "Sample List Mode".

- If no sample changer or a sample changer without magazine is connected, you can select "No Sample List" or "Sample List".

  The "No Sample List" mode is set by default. On the main screen, the button <Quick Settings> is displayed.

  If the "Sample List" mode is selected, the button <Sample List> is displayed instead of the <Quick Settings> button on the main screen.

- If a sample changer with magazine is connected, you can select "Simple" mode or "User-defined" mode. For details, see the corresponding Xsample instruction manual.

3. Define the "Automatic Sample Name" ("Sample Name Prefix" and "Sample Name Postfix").
4. Tap <OK> to save the changes.

To set user-defined data fields

1. Tap <Menu> and select **"Setup > Measuring System Settings > Sample List > User-defined Data Fields"**.
2. Activate/deactivate the three "User-defined Data Fields", enter their names and tap <OK> to save the changes.

To set sample list warnings

The sample list warnings are only generated if you prepare a sample list prior to any measurement.

1. Tap <Menu> and select **"Setup > Measuring System Settings > Sample List > Sample List Warnings"**.
2. Use the two check boxes to activate/deactivate the "Sample List Warnings":

   - Warn if sample list contains a sample without a name.
   - Warn if sample list contains methods with different measurement temperatures.

3. Tap <OK> to save the changes.

To set mandatory data fields

You can set the sample name and user-defined data fields as mandatory.

1. Tap <Menu> and select **"Setup > Measuring System Settings > Sample List > Mandatory Data Fields"**.
2. Use the check box(es) to define whether it is mandatory to enter a sample name or content for user-defined data fields for each measurement.
3. Tap <OK> to save the changes.

Related topics

Using the "Sample List" Mode: Chapter 13.3

10.4 Installing User Accounts and Passwords

When delivered, the instrument is freely accessible without password. Three user accounts are factory preset. The default passwords are set to "user name", written in lower case letters, e.g. "administrator" is set as the password for the "administrator" user. For the "administrator" user, the auto logon function is activated.

10.4.1 User Groups, Auto Logon, Naming Rules and Password Rules

User groups

There are three user groups which have different levels of user rights:

	Operator This user group may perform measurements, select a method, edit the sample list and perform checks.
	Manager This user group has the rights of the operator user group and may additionally perform adjustments.
	Administrator This user group has the right to access the whole menu.

Naming rules

User names must have at least one character. Allowed are characters from the ASCII table which are letters, numbers and most special characters.

If you operate the instrument in the increased security mode, user names must have at least six characters.

NOTICE
If the increased security is activated, user accounts that do not comply with the naming rules or password rules will be deactivated.

User names are not case sensitive.

Password rules

With low security levels, giving a password is not mandatory. If you do not set a password, users can log on by selecting their user name from the user list only.

The password must have at least one character. Allowed are characters from the ASCII table which are letters, numbers and most special characters. The password is case sensitive, for example "Anton Paar" or "anton paar" does make a difference in the logon.

With high security levels (21 CFR Part 11 and "Increased Security"), giving a password is mandatory. Passwords must have at least six characters. When setting new passwords, the last five passwords must not be used.

Auto logon function

You can assign the auto logon function to one user in the menu **"Setup > User Management"**.

If this user is logged on and the instrument is switched off and on again, there is no logon procedure. All instrument functions according to user rights of the auto logon user are freely accessible.

Example: The user "smith" belongs to the user group "Operator" and the auto logon function is activated for him. If he switches off the instrument, anyone can switch the instrument on and start measuring without a need to log on. Only operator level functions are available.

NOTICE
If the increased security is activated, auto logon will automatically be disabled (if enabled before).

10.4.2 Creating, Editing and Deleting User Accounts

You need administrator rights to create, edit or delete user accounts. Up to 50 user accounts can be created.

TIP

- *A user with a deactivated account cannot log on until he/she is activated again.*
- *A user who has no administrator rights can only change his own password.*

To create or edit a user account

1. Tap <Menu> and select **"Setup > User Management"**.

2. Tap <New> to create a new user account or highlight a user name on the user list and tap <Edit> to edit a user account.

   The "Edit User" dialog opens.

3. Perform the following settings:

   - Activate/deactivate the user account with the check box.
   - Enter a "User Name".
   - Select the "User Group".
   - Activate/deactivate the "Auto log on" using the second check box.
   - Select the "Role for the Electronic Signature".

4. If you want to set or change the password, tap <Set Password>, enter the password in the following dialog and tap <OK>.

5. Tap <OK>.

To delete a user account

You cannot delete your own account (i.e. the currently active account) or an account of a user group that has a higher level of user rights than your own account.

1. Tap <Menu> and select **"Setup > User Management"**.

2. Highlight a user name on the user list and tap <Delete>.

To set or change a password

If the instrument is operated in increased security mode, you may not use the last five passwords a second time.

1. Tap <Menu> and select **"Setup > User Management"**.

2. Tap <New> to create a new user account or highlight a user name on the user list and tap <Edit> to edit a user account.

3. To set or change the password, tap <Set Password>, enter the password in the following dialog and tap <OK>.

4. Tap <OK>.

Related topics

Logging On/Off: Chapter 8.7
Electronic Signature: Chapter 16.1.5

11 Checking, Adjusting and Calibrating the Instrument

11.1 Definitions

Checking

Checking the correct state of operation of an instrument by measuring a sample of exactly known measurement properties and comparing the result with the expected values.

Adjusting

Enabling correct measurements in the future by injecting a sample of exactly known measurement properties (standard) and adjusting the instrument constants in a way that the known correct results are found by the instrument.

Usually at least two standards are needed with measurement properties that encompass the expected measurement results of your samples for a successful adjustment.

Calibrating

Calibrations are checking procedures which are carried out using certified standards. By comparing the measured result with the standard reference value, you can validate the quality of your measurements.

11.2 Checks

11.2.1 Editing the Check Settings

You can edit the name, method (custom check only), time interval and the tolerance of density checks.

Tolerance

The factory presets for the check tolerance for both air and water checks are:

DMA M Model	Tolerance
DMA 4100 M	0.0002 g/cm³
DMA 4500 M	0.0001 g/cm³
DMA 5000 M	0.00005 g/cm³

To edit the settings of the Air Check and Water Check

1. Tap <Menu> and select **"Setup > Expert Settings > Check Management"** to open the check administration list.

2. Highlight the **"Air Check"** or **"Water Check"** and tap <Edit> to open the two-step "Check Edit" wizard.

3. Perform the following settings:

   - Enter a name for the check.
   - Use the check box "Must be started every" to define if the check is obligatory and enter a time interval in days.

4. Tap <Next>.

   - Define the maximum allowed lower and upper deviation.

5. Tap <OK>.

To create a custom check

1. Tap <Menu> and select **"Setup > Expert Settings > Check Management"** to open the check administration list.

2. Tap <New> to open the two-step "Check Edit" wizard.

3. Perform the following settings:

   - Enter a name for the check.
   - Select the method to define detailed method settings for the check, e.g. in the method "Density".
   - Use the check box "Must be started every" to define if the check is obligatory and enter a time interval in days.

4. Tap <Next>.

   - Select the quantity.
   - Define the check tolerance entering the lower and upper value.

5. Tap <OK>.

To edit a custom check

1. Tap <Menu> and select **"Setup > Expert Settings > Check Management"** to open the check administration list.

2. Highlight a custom check and tap <Edit> to open the two-step "Check Edit" wizard.

3. Change the settings as required.

11.2.2 Performing Density Checks

With density checks, carried out in regular intervals, you can ensure a high and stable accuracy of your density and concentration measurements.

During a density check, you fill a medium of known density (air, water or any customer-specific standard liquid) into the measuring cell and compare the measured density with the reference value.

The M series DMA performs the water checks and air checks automatically at the measuring temperature of the method that is currently active. Also the predetermination/equilibrium type of measurement is used according to the selected method. The density of water and air at the measuring temperature is calculated and the actually measured density is compared with the calculated value. With water checks and custom checks, this calculated value is calculated for the set temperature. With air checks, the calculated value is calculated for the set temperature and the measured air pressure.

Custom checks have to be defined for a certain method and are always performed at the temperature of the selected method with the corresponding predetermination/equilibrium type of measurement.

Air checks and water checks are available for any method.

When to do water checks and custom checks

Use the water check and custom check to verify that the instrument is measuring with satisfactory accuracy. We recommend performing a water check or custom check every day before starting the measurements. Perform additional water checks or custom checks on demand depending on your judgment, e.g. when you get unexpected results.

When to do air checks

Use the air check to evaluate the efficiency of your cleaning and drying procedure. We recommend performing an air check every day after the measurements have been finished and the measuring cell was cleaned and dried.

Perform additional air checks on demand depending on your judgment, e.g. after the measurement of critical samples that might stick to the measuring cell (e.g. samples containing adhesives, sticky particles, proteins).

To perform a density check

1. Tap <Menu> and select **"Checks/Adjustments > Checks"** to open the checks list.
2. Highlight a list item and tap <Start>.
3. Follow the instructions on the screen.

For a water check use freshly degassed ultra-pure (bi-distilled or deionized) water.

For an air check clean and dry the measuring cell properly.

Use the camera image to check whether the measuring cell is clean or water was filled bubble free.

When the check is finished, the following information is displayed:

- Check type
- Date and time
- Current method
- Check result ("passed" or "not passed")
- User name
- Air pressure (for air checks only)
- Reference value calculated for the set temperature
- Tolerance of the check (upper and lower value)
- Measured value

4. Tap <Print or Export> if you want to print or export the check results.

5. Tap <OK> or <Main Screen> to exit the density check.

If the water check failed, we recommend taking corrective actions until the check is valid again:

- Take a look at the camera image attached to the result to check if the water was filled bubble free (see Chapter 11.2.3).

- Check the quality of the water.

- Clean the measuring cell thoroughly.

- If the above mentioned actions do not help, perform an air/water adjustment.

11.2.3 Viewing, Printing or Exporting Current Check Data

The total number of entries in the check history is limited to 100.

1. Tap <Menu> and select **"Data Memory > Check/SOP Data"**.

2. Highlight a list item and tap <Detail>.

3. To perform a printout on paper or to a PDF file or to export the data as an MS Excel or Text file tap <Print or Export> and follow the instructions on the screen.

Related topics

Density Tables: Appendix I
Degassing Samples: Appendix B.1
Filling Samples: Chapter 13.4
Cleaning and Drying the Measuring Cell: Chapter 14.1
Performing an Air/Water Adjustment: Chapter 11.3.1

11.3 Adjustments

11.3.1 Performing an Air/Water Adjustment

An air/water adjustment has to be performed if the water check had a "not passed" result and using freshly degassed ultra-pure water and cleaning the measuring cell did not help.

The adjustment media are dry air and freshly degassed ultra-pure (bi-distilled or deionized) water.

The ThermoBalance™ technology allows for precise measurements over the whole temperature range with only one adjustment at 20 °C. To achieve the maximum possible precision of measurements at different temperatures, you can additionally perform a temperature range adjustment (see Chapter 11.3.2).

The air/water adjustment takes 5 to 10 minutes if the instrument is already clean and dry and equilibrated to 20 °C.

The adjustment procedure can be aborted by tapping <Cancel>.

To perform an air/water adjustment

1. Tap <Menu> and select **"Checks/Adjustments > Air/Water Adjustment"**.
2. Rinse the measuring cell.

TIP *If you use undenatured ethanol as the last rinsing liquid, only 3-4 minutes drying time are required.*

3. Tap the <Air Pump on> button to dry the measuring cell.
4. Tap <OK>.

   The atmospheric pressure is displayed. The air pressure is measured automatically by a built-in sensor.
5. Tap <OK>.

   The air adjustment routine is carried out.
6. Fill freshly degassed ultra-pure (bi-distilled or deionized) water into the measuring cell and tap <OK>.
7. Check that the water is filled without air bubbles.

TIP *If the water was filled without air bubbles, you can ignore a possible error message "Density Condition: filling warning" during the adjustment routine. The coefficients for the FillingCheck™ function are also adjusted during the adjustment procedure.*

The water adjustment routine is carried out.

When the adjustment is finished, the following information is displayed:

- Old Value: Calculated density of water of the previous adjustment.
- New Value: Calculated density of water with the new adjustment constants.
- Deviation: Relative and absolute deviation between new and old value.

8. Check the recommendation on the screen and select one of the options <Reject>, <Print> or <Apply>.

Related topics

Cleaning and Drying the Measuring Cell: Chapter 14.1
Degassing Samples: Appendix B.1
Filling Samples: Chapter 13.4

11.3.2 Performing a Temperature Range Adjustment

You can adjust your instrument over the whole temperature range to reach the maximum accuracy for measurements at different temperatures than 20 °C.

During the temperature range adjustment, an air adjustment is performed at 40 °C and 60 °C, then a water adjustment at 60 °C and 40 °C.

The whole adjustment takes about 30 minutes.

The adjustment procedure can be aborted by tapping <Cancel>.

1. Tap <Menu> and select **"Checks/Adjustments > Other Adjustments > Density Module > Temperature Range Adjustment"**.

2. Follow the instructions on the screen.

3. Check that the water is filled without air bubbles.

TIP *If the water was filled without air bubbles, you can ignore a possible error message "Density Condition: filling warning" during the adjustment routine. The coefficients for the FillingCheck™ function are also adjusted during the adjustment procedure.*

Related topics

Measuring at Low/High Temperatures: Appendix C.2

11.3.3 Performing a High Density/High Viscosity Adjustment (DMA 5000 M only)

With a DMA 5000 M, you can perform an adjustment at high density and/or at high viscosity to reach an exceptionally high accuracy for the measurement of high density values and/or samples with a high viscosity.

For the high density adjustment you need a standard that has a high density (higher than 1.40000 g/cm³), but low viscosity (similar to water).

For the high viscosity adjustment, you need two standards:

- One standard with a viscosity of approx. 100 mPa·s (±5 mPa·s) and with exactly known density (±0.00002 g/cm³).
- One standard with a viscosity of approx. 200 mPa·s (±5 mPa·s) and with exactly known density (±0.00002 g/cm³).

The adjustment procedure can be aborted by tapping <Cancel>.

1. Tap <Menu> and select **"Checks/Adjustments > Other Adjustments > Density Module > High Density/Viscosity Adjustment"**.

2. Follow the instructions on the screen.

   First an air and water adjustment is performed.

   When the adjustment is finished, the following information is displayed:

   - Old Value: Calculated density of water of the previous adjustment.
   - New Value: Calculated density of water with the new adjustment constants.
   - Deviation: Relative and absolute deviation between new and old value.

3. Check the recommendation on the screen and select <Special> if "Apply" is recommended.

4. For filling the high-density standard and the two viscosity standards, follow the instructions on the screen.

   After the adjustment with the high-density standard, select <Visc. Standard 1> and after the adjustment with the first viscosity standard select <Visc. Standard 2>.

   Check that the standards are filled without air bubbles.

TIP *If the standard was filled without air bubbles, you can ignore a possible error message "Density Condition: filling warning" during the adjustment routine. The coefficients for the FillingCheck™ function are also adjusted during the adjustment procedure.*

11.3.4 Performing an Atmospheric Pressure Adjustment

You can adjust the built-in atmospheric pressure sensor.

1. Tap <Menu> and select **"Checks/Adjustments > Other Adjustments > Density Module > Atmospheric Pressure Sensor Adjustment"**.

2. Use a calibrated external pressure sensor to get an exact pressure value.

   Do not use the atmospheric pressure that you can get from a local weather station, because this usually is not the absolute atmospheric pressure, but a calculated atmospheric pressure at sea level.

3. Tap <OK> to start the adjustment.

4. Enter the atmospheric pressure (in hPa) and tap <OK>.

5. Wait for the adjustment to be finished and then tap <OK>.

   The final value may deviate from the one you entered by up to ±7 hPa. This will not influence the measuring accuracy.

11.3.5 Performing Special Adjustments

11.3.5.1 Special Adjustments

Special adjustments are user-specific adjustments for special density units, concentrations and temperatures. After a successful adjustment procedure, the special adjustment can be used as a standard measuring quantity that is displayed and printed. It can also be used:

- as an input parameter for a user function
- as the API input quantity
- as the input quantity for the Canadian excise alcohol table

Five different special adjustments can be stored. For each special adjustment name, unit and temperature can be specified.

During a special adjustment, density coefficients are calculated from the oscillation period of two liquids of known density according to:

$$\rho = A \times PQ^2 - B$$

ρ ..... density
A, B .. density coefficients
PQ ... period of oscillation

Prerequisites for standards

The densities of the two liquids that are used for special adjustment have to differ by at least $\Delta\rho = 0.01$ g/cm³.

The PQ-values of the adjustment media have to differ by at least 0.0001.

Special adjustments can be performed at any set temperature within the specified temperature range (0 to 90 °C or 32 to 194 °F).

Hints for measurements using special adjustments

If the instrument is operated using a special adjustment, the set measuring temperature must be the same as the temperature at which the special adjustment was performed. Otherwise no results will be obtained.

No viscosity correction is available if the instrument is operated using a special adjustment.

No adjustment history is available for special adjustments.

To perform a special adjustment

1. Tap <Menu> and select **"Checks/Adjustments > Other Adjustments > Density Module > Special Adjustments"**.
2. Use the drop-down box "Adjustments" to select one of the 5 available "Special Adjustment" entries and tap <OK>.
3. Enter "Name" and "Unit" for the special adjustment.
4. Define the "Temperature" and tap <OK> to continue.

   The special adjustment routine starts.
5. Rinse the measuring cell.
6. Press the <Air Pump on> button to dry the measuring cell.
7. Fill the first standard into the measuring cell and tap <OK>.

   Check that the standard is filled without air bubbles.
8. Enter the reference value for the first standard and tap <OK>.
9. Enter the reference value for the second standard and tap <OK>.
10. Rinse the measuring cell.
11. Press the <Air Pump on> button to dry the measuring cell.
12. Fill the second standard into the measuring cell and tap <OK>.

    Check that the standard is filled without air bubbles.
13. Check the recommendation on the screen and select one of the options <Print>, <Reject> or <Apply>.

    After successful adjustment, the determined special adjustment coefficients are stored. A new output quantity is generated in the group "Special Adjustments" which is calculated using these coefficients.

TIP *The new output quantity will only calculate valid results in methods using the same set temperature as the previously performed special adjustment.*

11.3.5.2 Special Adjustment for the Canadian Excise Alcohol Table

To use the output quantity "Canadian Excise Alcohol Table" (see Appendix F), it is necessary to perform a special adjustment with apparent density values of air and water and link that adjustment to the Canadian Excise Alcohol Table.

1. Perform a special adjustment with air and water using apparent density for the reference values.
2. Link the special adjustment to the Canadian Excise Alcohol Table (see Chapter 12.2.6).
3. Select the table for output fields, result outputs and the data browser.

11.3.6 Viewing, Printing or Exporting Adjustment Data

You can view, print and export the detailed data for the last 50 adjustments both for density and temperature.

1. Tap <Menu> and select **"Data Memory > Adjustment Data > Density Module"** and select **"Density Adjustment", "Special Adjustment"** or **"Temperature Adjustment"** to open the respective adjustment list.
2. Highlight a list item and tap <Details> to see the detailed adjustment data.
3. To perform a printout on paper or to a PDF file or to export the data as an MS Excel or Text file tap <Print or Export> and follow the instructions on the screen.

11.3.7 Viewing, Printing or Exporting Adjustment History: KB Graph

You can view, print and export the KB values for the last 50 adjustments in form of a graph.

1. Tap <Menu> and select **"Data Memory > Adjustment Data > Density Module > Density Adjustment KB Graph"**.
2. To perform a printout on paper or to a PDF file, tap <Print or Export> and follow the instructions on the screen.

   RS-232 printers with paper roll cannot print the KB graph.

11.3.8 Resetting the Adjustment Data to Factory Adjustment

You can re-activate the factory adjustment for the density measurement.

1. Tap <Menu> and select **"Checks/Adjustments > Other Adjustments > Density Module > Reset to Factory Adjustment"**.

2. Activate the check box "Density Module" and tap <OK>.

11.4 Calibrating

The goal of a calibration is to validate the accuracy of the density measurement.

To calibrate the instrument, measure a certified standard liquid and compare the result to the reference value indicated in the calibration certificate of the standard.

The physical properties (density, viscosity) of the liquid density standards should be similar to those of the samples.

The frequency of calibrations with certified liquid density standards depends on your requirements and judgment. Recommendation: 1 to 2 calibrations per year.

NOTICE

- Always check the date of expiry of the calibration liquids.
- Store the calibration liquids in a cool and dark place.
- Use the calibration liquids immediately and only once after the container has been opened.

To perform a calibration

1. Perform a density check with water.
2. If necessary, carry out an air/water adjustment at 20 °C.
3. Thoroughly clean and dry the measuring cell.
4. Select a measuring method that is set to "20 °C" and "measurement finished by equilibrium". For DMA 5000 M, use the setting "measurement finished by equilibrium slow".
5. Open the bottle with the liquid density standard.

TIP *If your bottle with density standard has a septum, we recommend you pierce it carefully with any clean, sharp tool and fill a Luer tip syringe with standard liquid by pushing the tip into the hole of the septum, holding the bottle upside down and slowly pulling the plunger.*

6. Immediately after opening the bottle, inject the standard into the measuring cell of your M series DMA.
7. Perform a measurement.

TIP *If you have enough standard liquid, we recommend making a series of three measurements and take the arithmetic average of the results.*

8. After the measurement is finished, print the result.

9. Document the calibration procedure in a calibration protocol which contains the operator's name, date, place, description of the calibration procedure, results and the calibration certificate of the liquid density standard.

Related topics

Performing Density Checks: Chapter 11.2.2
Performing an Air/Water Adjustment: Chapter 11.3.1
Cleaning and Drying the Measuring Cell: Chapter 14.1
Defining and Using Methods: Chapter 12
Performing Measurements: Chapter 13.5

12 Defining and Using Methods

12.1 Measuring Methods

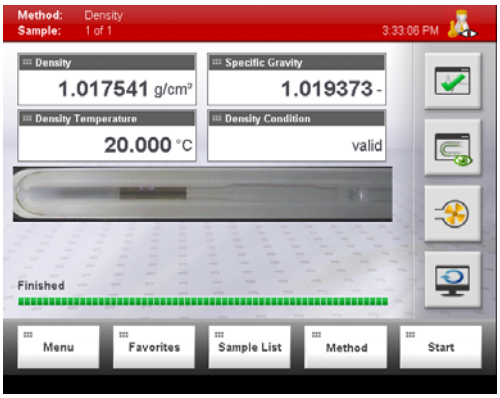
Each method contains the following kind of information:

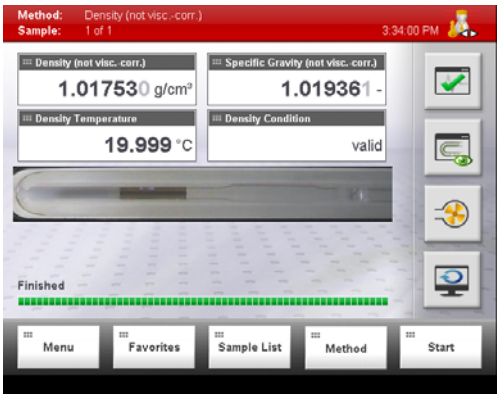
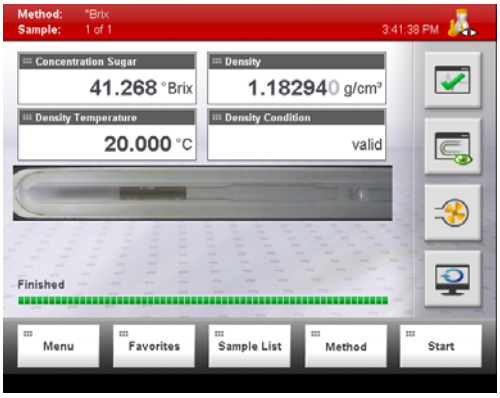
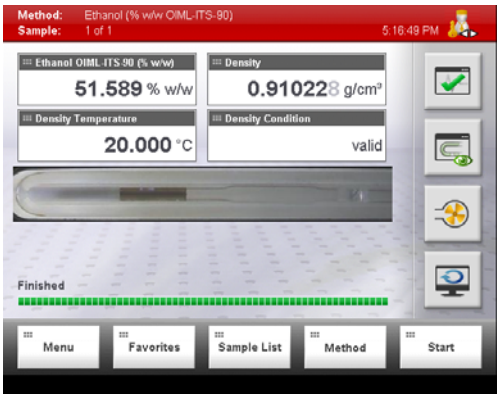
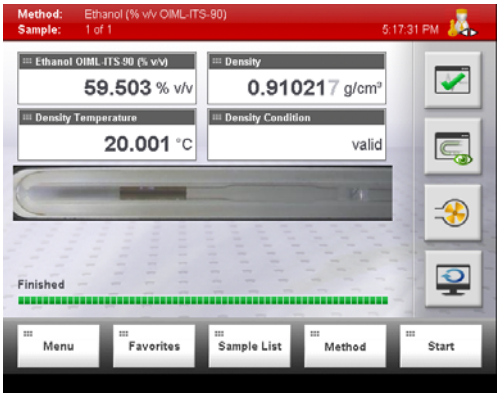
- Instrument settings
- Xsample settings and measuring module settings (if any module is installed)
- Layout of measuring data on the main screen
- Measuring units
- Parameter list for printout and data export

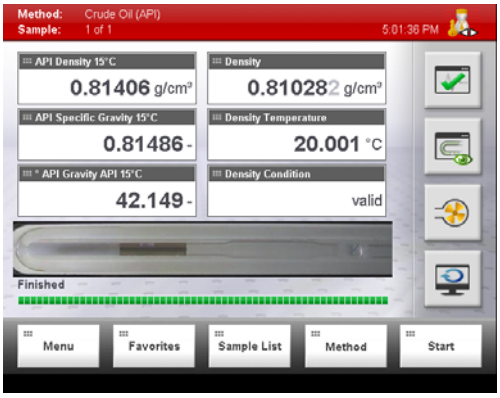
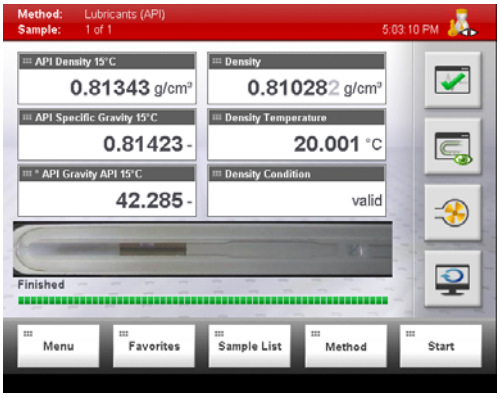
You can use the factory preset methods as they are or change them to suit your needs (see Chapter 12.2). You can also create new methods (see Chapter 12.3).

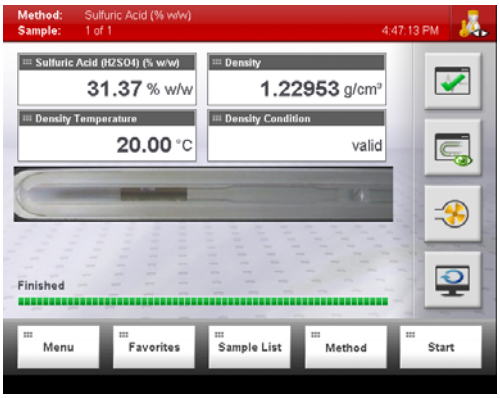
Factory preset methods

The DMA M is delivered with a set of 10 predefined methods covering the most common applications. The measuring temperature for these 10 methods is set to 20 °C.

	**Density** • Density, Specific Gravity, Density Temperature, Density Condition, U-View™ • General purpose method

	**Density (not visc.-corr.)** • Density (not visc.-corr.), Specific Gravity (not visc.-corr.), Density Temperature, Density Condition, U-View™ • General purpose method, for comparison with old instruments without viscosity correction
	**°Brix** • Concentration Sugar, Density, Density Temperature, Density Condition, U-View™ • For measurements of sugar in soft drinks
	**Ethanol (% w/w OIML-ITS-90)** • Ethanol OIML-ITS-90 (% w/w), Density, Density Temperature, Density Condition, U-View™ • For measurements of alcohol concentration in distillates
	**Ethanol (% v/v OIML-ITS-90)** • Ethanol OIML-ITS-90 (% v/v), Density, Density Temperature, Density Condition, U-View™ • For measurements of alcohol concentration in distillates

	Ethanol (°Proof 60 °F AOAC) • Ethanol Proof 60 °F, Density, Density Temperature, Density Condition, U-View™ • For measurements of alcohol concentration in distillates
	**Crude Oil (API)** • API Density 15 °C, Density, API Specific Gravity 15 °C, Density Temperature, °API Gravity 15 °C, Density Condition, U-View™ • For measurements of crude oil according to calculations for product group A with temperature correction to 15 °C
	Fuel Oil (API) • API Density 15 °C, Density, API Specific Gravity 15 °C, Density Temperature, °API Gravity 15 °C, Density Condition, U-View™ • For measurements of fuel oil according to calculations for product group B with temperature correction to 15 °C
	**Lubricants (API)** • API Density 15 °C, Density, API Specific Gravity 15 °C, Density Temperature, °API Gravity 15 °C, Density Condition, U-View™ • For measurements of lubricants according to calculations for product group D with temperature correction to 15 °C

	**Sulfuric Acid (% w/w)** • Sulfuric Acid (H_2SO_4) (% w/w), Density, Density Temperature, Density Condition, U-View™ • For measurements of sulfuric acid up to 94 % w/w

12.2 Changing Methods

You need administrator rights to create, edit or delete methods. Up to 50 methods can be created.

12.2.1 Defining Measuring Settings

For each method, you can set the following measuring parameters for measurements:

- Measurement finished by predetermination or temperature equilibrium (measuring cell temperature = set temperature).

  If you select **Predetermination**, the instrument finishes the measurement before temperature equilibrium was reached and calculates the density at the set temperature in advance. This saves time but makes the result less accurate.

  If you select **Equilibrium**, the measurement finishes after temperature equilibrium was established.

  DMA 5000 M: With this instrument, you have the choice between predetermination, equilibrium fast, equilibrium medium and equilibrium slow. The slower the equilibrium, the more accurate are the results.

- Measuring temperature.

- Timeout: If a measurement is not finished after the specified timeout, it will be aborted. The timeout count starts when temperature equilibrium is reached.

To define the measuring settings

1. Tap <Menu> and select **"Methods > Method Settings > "Method Name" > Density Module"**.

2. Select the predetermination/equilibrium type of measurement.

3. Enter the "Measuring Temperature".

4. Define the "Timeout".

5. Use the drop-down box "FillingCheck™" to select one of the options:

   - always active
   - active during a measurement
   - not active

6. Tap <OK>.

12.2.2 Defining the Displayed Output Fields

For each method, you can select the number and content of output fields on the display.

TIP *We recommend having always the output field "Density Condition" in addition to the measurement values on the screen.*

To define the number of output fields

When switching to another display layout, the contents of the output fields of the previous display layout are transferred to the new layout.

1. Tap <Menu> and select **"Methods > Method Settings > "Method Name" > Display Layout"**.

2. Highlight a list item and tap <OK>.

To define the content of output fields

You can directly change the content of output fields in the main screen. The changes are automatically saved in the current method.

1. Tap on the output field.

2. Select the "Group", "Quantity", "Unit" and number of "Digits" and tap <OK>.

TIP *Before you use the output quantity "Canadian Excise Alcohol Table" of the group "Ethanol Tables" (see Appendix F), it is necessary to perform a special adjustment with apparent density values of air and water (see Chapter 11.3.5.2) and to link that adjustment to the Canadian excise alcohol table (see Chapter 12.2.6).*

12.2.3 Defining the Result Output

You can define the list of output quantities for printouts and data exports. You can change the settings any time and repeat the printout of saved results, if required.

If no output quantities are selected, the data browser settings are used instead (see Chapter 15.2).

To define the list of output quantities

1. Tap <Menu> and select **"Methods > Method Settings > "Method Name" > Result Output"**.
2. Tap on the list item that you want to change or on the empty field at the bottom of the list if you want to add an item.

   The row is highlighted.
3. Tap on the highlighted list item to get to the "Change Quantity" dialog.
4. Use the drop-down boxes to define the "Group", "Quantity", "Unit" and the number of "Digits".
5. Tap <OK>.

To change the sequence of the result output items

1. Tap <Menu> and select **"Methods > Method Settings > "Method Name" > Result Output"**.
2. Highlight a list item and use the up/down arrows in the right column to change the position of the list item.
3. Proceed so with all other list items whose position you want to change and tap <OK>.

12.2.4 Defining Limits

Limits can be set for any parameter separately, e.g. density, concentration sugar etc.

If any of the selected quantities is out of the limited range, you will be warned with the yellow warning sign in the quick access area and a message in the "Diagnosis" window.

NOTICE
Limits are only applied in the measuring mode but not in the monitor mode.

To define limits

1. Tap <Menu> and select **"Methods > Method Settings > "Method Name" > Limits"**.
2. Select the quantity to be monitored in the column "Quantity".
3. Define the "Lower" and "Upper" limit for the selected quantity.
4. Tap <OK>.

12.2.5 Defining Multiple Measurements

Using multiple measurements enables you to perform several measurements automatically. A single entry in the sample list starts a series of up to 10 measurements of a sample and calculates the average value of these measurements.

Multiple measurements create an additional entry in the data memory as not only the single measurements but also the average values are calculated and stored.

NOTICE
If multiple measurements are activated for a certain method, it is no longer possible to define a temperature scan for the specific method in the sample list.

To define multiple measurements

1. Tap <Menu> and select **"Methods > Method Settings > "Method Name" > Multiple Measurement Settings"**.
2. Select the number of multiple measurement cycles.
3. Tap <OK>.

12.2.6 Defining Formula Parameters

You can enter formula parameters to define how API parameters shall be determined and to define which special adjustment shall be used for the Canadian excise alcohol table.

API parameters are usually calculated based on true density; the input quantity can be defined as:

- Density (not visc.-corr.)
- Density
- Special Adjustment 1, ..., 5

The API Product Group can be set to A (crude oil), B (fuels) or D (lubes) to set up measuring methods for different product groups.

The conversion formulas from input quantities (Density etc.) to API quantities differ between the product groups A, B and D and therefore need to be defined for the measuring methods.

The input quantity for the Canadian Excise Alcohol Table can be defined as:

- Special Adjustment 1, ..., 5 (see Chapter 11.3.5.2)

To define formula parameters

1. Tap <Menu> and select **"Methods > Method Settings > "Method Name" > Formula Parameters"**.
2. Select an API Product Group and API Input Quantity.
3. Select the special adjustment for the Canadian Excise Alcohol Table.
4. Tap <OK>.

12.2.7 Defining Quick Setting Parameters

Quick settings function

The quick settings function allows you to easily access different parameters concerning your measurement without changing the current method.

The quick settings comprise several measuring settings or functions and are available in all sample list modes. See Appendix G for an overview on the parameters that can be defined as quick settings.

Depending on the sample list mode, different quick setting parameters are set by default:

- If the "No Sample List" mode is used: Sample name, measurement type ("Type") and "Density Temperature"
- If the "Sample List" mode is used: Measurement type and "Density Temperature"

Additional parameters can be added to your quick settings for every method. User-defined data fields (see Chapter 10.3) and user functions of the "Constant" type (see Chapter 16.2) will be automatically added to your quick settings.

If you have connected one or more Anton Paar measuring modules to your master instrument, the range of parameters that can be added to your quick settings will be extended. See the instruction manual of your measuring module for information on the available parameters.

To set a quick setting parameter

1. Tap <Menu> and select **"Methods > Method Settings > "Method name" > Quick Settings Management"**.
2. Tap the insert field in the free line.
3. Use the "Quantity" drop-down box to select the desired parameter and tap <OK>.
4. Tap <OK> to save the settings.

To change the sequence of the quick setting parameters

1. Tap <Menu> and select **"Methods > Method Settings > "Method name" > Quick Settings Management"**.
2. Highlight a parameter and use the up or down arrow in the "Order" column to change the position of the parameter in the list.
3. Tap <OK> to save your settings.

To delete a quick setting parameter

TIP *The parameters "Sample name" and "Type" cannot be deleted.*

1. Tap <Menu> and select **"Methods > Method Settings > "Method name" > Quick Settings Management"**.
2. Highlight the parameter you want to delete and tap <Delete>.

12.3 Creating, Deleting, Hiding and Arranging Methods

You can copy, rename, hide and delete methods. The maximum number of methods is 50.

To create a new method, make a copy of the existing method which has the most similar method settings to the one you want to create. Then rename the new method and change its method settings to your needs.

NOTICE
Creating, deleting, hiding and arranging methods affects the position numbers in the method list. If you use bar codes for assigning methods, check the position numbers of your methods after these actions.

To copy a method

1. Tap <Menu> and select **"Methods > Method Management"** to open the method list.
2. Highlight a method name and tap <Copy>.

   A new method is created with the same method name as the original one and an additional number in brackets.

   The new method is saved in the last position of the method list.

To rename a method

1. Tap <Menu> and select **"Methods > Method Management"** to open the method list.

2. Highlight a method name and tap <Rename>.
3. Enter the new method name (up to 50 characters long).
4. Tap <OK>.

To delete a method

1. Tap <Menu> and select **"Methods > Method Management"** to open the method list.
2. Highlight a method name and tap <Delete>.

TIP *You cannot delete the currently used method. Change the method (see Chapter 12.4) and then delete the desired method.*

To set methods visible or invisible

If a method is set invisible, you cannot select this method any longer in the method list and the method settings.

1. Tap <Menu> and select **"Methods > Method Visibility"**.
2. Highlight a method.
3. Enable the check box to set the method visible or disable the check box to set the method invisible.
4. Tap <OK>.

To change the sequence of the method list

1. Tap <Menu> and select **"Methods > Method Visibility"**.
2. Highlight a method and use the up and down arrows in the "Order" column to change the position of the method in the list.
3. Proceed so with all other methods whose position you want to change and tap <OK>.

12.4 Selecting the Method

You can select the method using the <Method> button at the main screen or using the respective column in the sample list.

To select a method with the <Method> button

1. Tap <Method> to open the methods list.
2. Highlight a method either by tapping on its name or by using <▲> and <▼> and tap <OK>.

Related topics

Making a Backup of the Instrument Settings: Chapter 17.1

13 Measuring

In this chapter, the filling of samples and the measuring procedure including the detection of bubbles are described.

13.1 General Sample Settings

Sample name

If you have defined automatic sample name parts (see Chapter 10.3), they will be added to each sample name after measurement has been finished.

The complete sample name, including automatic sample name parts, may consist of up to 50 characters.

Measurement types

S (Standard)	To perform a standard measurement
C (Check)	To perform one of the predefined checks. It is only possible to select a check which has been defined for the selected method before.
MM (Multiple Measurements)	To perform several 2 to 10 measurements of a single sample automatically.
TS (Temperature Scan)	To perform a temperature scan.

- If you select "C (Check)", tap the column "Unit/Settings" and select one of the defined checks (Air Check and Water Check are predefined).
- If you select "MM (Multiple Measurements)", tap the column "Unit/Settings" and enter a value between 2 and 10.
- If you select "TS (Temperature Scan)", tap the column "Unit/Settings" and enter the "Start", "Step" and "End" temperature of the temperature scan.

  Make sure to set the temperature step interval so that the instrument can reach the end temperature by a whole number of steps (divide the interval between start and end temperature by whole numbers only to find appropriate step settings).

The minimum step size in temperature scans depends on the defined type of equilibrium (Measurement finished by) of the density module:

Measurement finished by	Minimum step size	Model
Predetermined	1 °C	DMA 4100/4500/5000 M
Equilibrium	0.02 °C	DMA 4100/4500 M
Equilibrium fast Equilibrium medium Equilibrium slow	0.02 °C 0.01 °C 0.005 °C	DMA 5000 M

13.2 Using the "No Sample List" Mode

If no sample changer or a sampler changer without magazine is connected, the simple mode is set by default (see chapter 10.3). You only need to tap <OK> to start a measurement.

You can use the quick settings function to change the following:

- Sample name and measurement type
- Measurement settings of the following measurement(s) without affecting the settings of the underlying method (see Chapter 12.2.7)

To change the sample settings

NOTICE
The new settings are maintained for following measurements until changes are made anew.

1. Tap <Quick Settings>.
2. Enter a sample name using the corresponding input field if needed.
3. Define your parameters if needed.
4. Tap <OK>.

13.3 Using the "Sample List" Mode

The sample list is a tool that helps you managing samples that you want to measure.

- No results are stored in the sample list but using the <Single Sample> button in the sample list links you to the data memory and you can view the results of already measured samples in the sample list.
- You can define temperature scans in the sample list.
- Checks can also be started from the **"Checks/Adjustments"** menu.
- Standard measurements can also be started from the main screen.

Number of entries

The sample list can contain up to 200 entries. The 201st entry overwrites the oldest entry. Entries older than 24 hours are automatically removed.

The sample list will be automatically cleared if you switch off the instrument.

NOTICE
In the "Sample List" mode and "Simple" mode, each measurement is entered into the data memory and the sample list. The maximum data storage volume of 1000 data is calculated from the already measured samples (data memory) plus the samples in the sample list. Therefore, regularly clear the sample list and the data memory.

To create or edit a sample list

TIP *If you have activated user-defined data fields (see Chapter 10.3), the data fields are shown in columns.*

1. Tap <Sample List> to open the sample list window.
2. To enter a sample name, tap on a cell in the column "Name".
3. Tap on a cell in the column "Method" and select a method from the drop-down list.
4. Tap on the ... icon in the column "Quick Settings" and select measurement type and measurement settings as desired.
5. To exit the sample list and save the changes, tap <Main Screen>.

To edit or delete a sample in the sample list

TIP *You cannot edit or delete samples in the sample list that have already been measured.*

- To edit a sample, highlight the row and change the settings as desired.
- To delete a sample from the list, highlight the sample and tap <Delete Sample>.
- To exit the sample list and save the changes, tap <Main Screen>.

To save a sample list

1. Tap <Sample List> and then <List Management>.
2. Select **"Save Sample List"** and then <OK>.

3. Choose one of the 10 available entries in the drop-down list "Sample list templates".

4. Tap <Rename> and enter a name for your sample list.

5. Tap <OK>.

To load a sample list

1. Tap <Sample List> and then <List Management>.

2. Select **"Load Sample List"** and then <OK>.

3. Choose one of the ten sample lists in the drop-down list "Sample list templates".

4. Tap <OK>.

To clear the current sample list

1. Tap <Sample List> and then <List Management>.

2. Select **"Clear Sample List"**.

   After the sample list was cleared, the symbol on the diagnosis quick access button may change: If the symbol was the yellow alarm signal or the red lightning, they will change to the green check.

Related topics

Setting Sample List Options: Chapter 10.3

13.4 Filling Samples

To achieve highly accurate measuring results, fill the samples into the measuring cell homogeneously and without bubbles.

WARNING

Filling samples and cleaning liquids which the wetted parts are not resistant to will corrode the wetted parts. Sample leaking from corroded parts may cause serious injuries.

Before filling any sample or cleaning liquid into your DMA M:

- make sure that all safety instructions concerning the use of chemicals and the use of flammable chemicals are met (see Chapter 2).
- make sure all wetted parts are resistant to the filled-in liquid (see Appendix A.2).
- make sure that you have suitable cleaning fluids at hand for cleaning the measuring cell (see Chapter 14.1).
- If a sample changer is connected, check the resistance of the wetted parts. For information about the materials, see the corresponding instruction manual of the sample changer.

NOTICE

Samples with a moderate tendency to corrode borosilicate glass such as strong alkali solutions (e.g. caustic soda) can be measured with the DMA M.

- However, take care to remove such samples immediately after measurement and rinse the measuring cells properly.
- Check the validity of the adjustment more frequently than generally recommended.
- Perform a new adjustment, if necessary.
- The measuring temperature for strong alkali solutions should not be higher than 20 °C. Higher temperatures dramatically increase the speed of corrosion.

Important for high accuracy measurements

If you use a syringe to fill the instrument, we recommend using a 2 mL syringe only to fully utilize the instrument's accuracy (especially with DMA 5000 M). Inject the entire sample volume. The syringe can stay connected to the filling adapter during the measurement.

If you use syringes with higher volumes, carefully disconnect the syringe from the filling adapter after filling the sample. Otherwise, errors due to the weight of the syringe are possible.

Make sure to apply exactly the same filling procedure for checks, adjustments and measurements.

Sample amount

If the measuring cell is clean and dry, you need approx. 1 mL of sample.

If you are measuring without cleaning and drying between the samples, you need a higher amount of sample because you have to flush residues of the previous sample out of the measuring cell to avoid cross-contamination.

Bubble detection using the camera (U-View™, DMA 4500/5000 M)

1. Tap the button in the quick access area to open the live camera view of the measuring cell.
2. Tap <Zoom In> to get a magnified view.
3. Attach a USB flash drive and tap <Save Picture> to save the current picture.
4. Tap <X> to exit the measuring cell view.

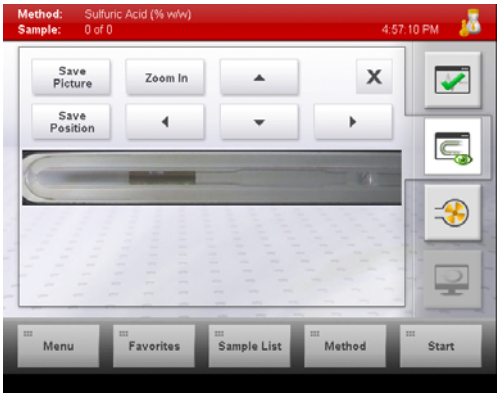


Fig. 13 - 1 Camera window

Bubble detection using the inspection window (DMA 4100 M)

You can check the quality of the filling visually by looking through the inspection window at the front of the instrument.

To fill with a syringe (Luer tip)

NOTICE
Do not use syringes that contain lubricants. The lubricants can dissolve into your sample and lead to a systematic measuring error.

Fig. 13 - 2 Filling with a syringe

1. Connect the syringe to the sample inlet adapter.
2. Push the plunger of the syringe slowly and continuously until a drop emerges from the sample outlet adapter.
3. Leave the syringe in the filling position during the measurement.

To fill with a funnel

1. Mount an adapter Luer cone to the sample inlet adapter.
2. Connect the adapter with a funnel using a silicone hose (3 x 5 mm).
3. Fix the funnel in a position higher than the sample inlet of the DMA M.
4. On the outlet of the DMA M, mount another adapter Luer cone and connect it to a waste vessel using a second silicone hose (3 x 5 mm).
5. Mount a valve or hose clamp at the outlet silicone hose.
6. Close the valve and fill your sample into the funnel.
7. Fill the measuring cell by carefully opening the valve and closing it again before the funnel runs empty.

To fill with a peristaltic pump

NOTICE

- The liquid levels in the sample container and waste container must be below the filling level of the instrument. Never put the peristaltic pump or waste container on top of the instrument.
- Check the hoses of the peristaltic pump daily.
- Check the life time of the hoses specified by the supplier and change the hose frequently.

1. Mount an adapter Luer cone to the sample inlet adapter.

2. Connect the adapter Luer cone with the sample container using a silicone hose (3 x 5 mm).

3. Mount an adapter Luer cone to the sample outlet adapter.

4. Connect a silicone hose (3 x 5 mm) to the adapter Luer cone and lead the silicone hose via the peristaltic pump to a waste vessel.

5. Set the flow rate to 10 to 25 mL per minute.

6. Start the pump.

7. Turn off the pump after filling a sufficient amount of sample.

To fill automatically with an Xsample

For details, see the respective Xsample instruction manual.

Related topics

Safety instructions: Chapter 2
Special filling techniques: Appendix B.2

13.5 Performing Measurements

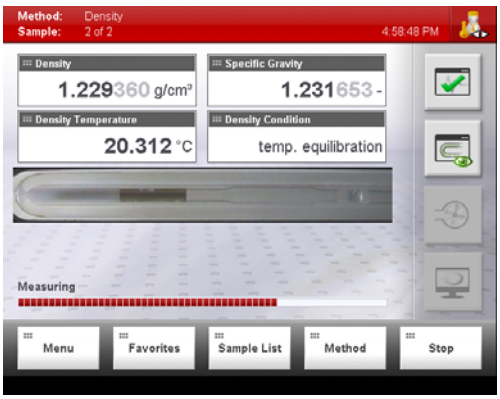
To speed up measurements

- Automatic sample naming: See Chapter 10.3.
- Prethermostatting: Prethermostat your samples to the measuring temperature before injection to reduce the time necessary for the temperature equilibration.
- Predetermination option: Using this option reduces the measuring time substantially (see Chapter 12.2.1).

To perform a measurement

1. Before starting a measurement, check if:
   - the hoses are connected correctly
   - the hose connections are tight
   - the waste hose leads into the waste container
   - the waste container’s volume is large enough for the number of samples
   - the correct sample names are entered
   - the method settings are set correctly
   - suitable cleaning liquids are available.
2. Fill the measuring cell with sample.
3. Enter a sample name if required.
4. Tap <Start> and wait until the measurement is finished.

The progress bar shows the progress of the measurement with a growing red bar and the message "Measuring".



During measurements the last 1, 2 or 3 digits might be gray colored. This means that the set temperature has not been reached yet. In that case, only the black colored digits are valid. The number of valid (black colored) digits increases during measurement progress until all digits are black (when using equilibrium mode).

When the measurement is finished, the progress bar turns green, the message "Finished" is displayed and an acoustic signal is given. The "Density Condition" output field shows the message "valid".

The result values are frozen. The display can be unfrozen by tapping the button.

The result values are saved in the data memory and can be viewed, printed, exported or deleted.

5. Measure the next sample or clean and dry the measuring cell.

Related topics

Safety Instructions: Chapter 2
Mounting the Hoses: Chapter 7.4
Measuring Methods: Chapter 12.1
Using the "Sample List" Mode: Chapter 13.3
Filling Samples: Chapter 13.4
Cleaning and Drying the Measuring Cell: Chapter 14.1
Handling the Measurement Data: Chapter 15
Measuring at High Humidity/Low Temperature Conditions: Appendix C.1
Measuring at Low/High Temperatures: Appendix C.2
Degassing Samples: Appendix B.1

13.6 Filling and Measurement Errors

13.6.1 Status Messages

Density condition

The "Density Condition" output field gives information about the current status of measurement and may show the following messages:

temp. equilibration	Appears during temperature equilibration. In this stage no predetermined result can be determined by the instrument.
predetermined	Appears before the exact measuring temperature has been reached and the instrument can determine a predetermined result.
valid	Appears when the measuring temperature has been reached and the measurement has been taken.

Sample status icons

In the first column of the sample list, you find an icon for each sample that has already been measured. The icon indicates the status of the sample:

	The sample was successfully measured.
	Reduced precision due to e.g. a filling error.
	No result due to a malfunction.

13.6.2 Error Messages

Automatic bubble detection (FillingCheck™)

If a bubble has been detected anywhere in the U-tube in real time, the "Density Condition" output field shows "Filling Warning" or "Error: No Oscillation" for the current sample and the diagnosis quick access button changes: Instead of the green check mark, the yellow alarm sign is displayed.

Note: For complete transparency and traceability of your sample filling and measurement process, check the filling visually by means of the built-in camera (U-View™, DMA 4500/5000 M) or the inspection window (DMA 4100 M) in addition to the fully automatic FillingCheck™.

TIP *FillingCheck™ provides excellent support to the operator for samples of low and medium viscosity ranges. High viscous samples above 3000 mPa·s, which firmly enclose contained air bubbles, might not be analyzed correctly and generate a filling warning even if filled without bubbles.*

Diagnosis window

The appearance of the <Diagnosis> quick access button indicates the current error status (see the section "Quick access buttons" in Chapter 6.4). Tapping the button opens the diagnosis window where the general status of the DMA M and the measuring errors that occurred within the current sample list are displayed.

14 Cleaning and Storing the Instrument

To assure a constant and high accuracy of your measurements, employ a regular and effective cleaning routine and store the instrument under the recommended conditions.

14.1 Cleaning and Drying the Measuring Cell

WARNING
Liquids leaking from the instrument may lead to injuries and risk of fire.
Before filling any sample or cleaning liquid into your DMA M, make sure that:
- all safety instructions concerning the use of chemicals and the use of flammable chemicals are met (see Chapter 2).
- all wetted parts are resistant (see Appendix A.2).

NOTICE
Do not use any mechanical action for cleaning the measuring cell.

Cleaning frequency

Clean and dry the measuring cell at least after each working day or working shift.

Cleaning more frequently can be necessary ...

- when you perform adjustments.
- when you measure a sample that is not miscible with the previous sample (e.g., water after a petrochemical sample).
- when you want to measure using a minimum sample amount.
- when you measure a sample that could chemically react with the previous sample.

Cleaning liquids

For cleaning and drying, employ two cleaning liquids:

- Cleaning liquid 1 dissolves and removes sample residues in the measuring cell. It has to be a good solvent for all sample components.
- Cleaning liquid 2 removes cleaning liquid 1 and is easily evaporated by a stream of dry air in order to accelerate drying of the cell. Cleaning liquid 2 has to be a good solvent for cleaning liquid 1.

Recommended for aqueous samples and beverages: water (cleaning liquid 1) and non-denatured ethanol (cleaning liquid 2).

Recommended for petrochemical samples: petroleum naphtha (cleaning liquid 1) and acetone (cleaning liquid 2).

If you are not sure if a cleaning liquid is suitable for your sample, perform a preliminary test in a test tube to see if any phase separation, precipitate or opalescence can be observed.

To perform a cleaning and drying procedure without Xsample filling equipment

1. Rinse the measuring cell with cleaning liquid 1 (minimum 5 mL).

   If your sample is viscous or contains particles, use more cleaning liquid.

2. Empty the measuring cell.
3. Rinse the measuring cell with cleaning liquid 2 (minimum 5 mL).
4. Empty the measuring cell.
5. Insert the air pump hose with the adapter Luer cone into one of the injection adapters.

Fig. 14 - 1 Drying the measuring cell

6. Tap the button in the quick access area to start the air pump.

7. Wait until the measuring cell is dry (stable density reading).

   The time needed depends on the vapor pressure of your cleaning liquid 2 and the temperature of the measuring cell (Ethanol at 20 °C: approx. 5 min., Acetone at 20 °C: approx. 3 min.).

   If the ambient humidity is larger than 90 % relative humidity, use a drying cartridge (see Appendix C.1) to reduce the drying time.

8. Tap the button in the quick access area to stop the air pump or wait for the pump time out.

To perform a cleaning and drying procedure with Xsample filling equipment

For details, see the respective Xsample instruction manual.

Related topics

Safety Instructions: Chapter 2
Performing Density Checks: Chapter 11.2.2
Air Pump Settings: Chapter 10.1.4
Measuring at High Humidity/Low Temperature Conditions: Appendix C.1

14.2 Storing the Instrument

Clean and dry the measuring cell (see Chapter 14.1) before storing the instrument for more than one day. Otherwise, algae may grow on the glass surface that are difficult to remove.

For storage for less than one day, the measuring cell can be filled with deionized water or the last cleaning liquid that has been injected. In case of syringe injection, leave the syringe mounted to the injection adapter to prevent spillage of the liquid.

14.3 Cleaning the Instrument Housing and Touch Screen

To clean the instrument housing or the touch screen, use a soft tissue that can be wetted with ethanol or warm water, if necessary with some mild cleaning agent added (pH < 10).

WARNING

Ethanol is a highly flammable liquid.

- Make sure that all safety instructions regarding the use of flammable liquids (see Chapter 2) are strictly followed.

NOTICE

Never use:

- highly nonpolar solvents (e.g. toluene, hexane, solvent naphtha)
- strong acids or bases (e.g. nitric acid, sulfuric acid, hydrochloric acid, caustic soda)
- strong mechanical action (steel brush).

Related topics

Measuring in Harsh Environments: Appendix C.4

15 Handling the Measurement Data

15.1 Defining the Data Memory Settings

Your instrument can store 1000 result data files with or without camera pictures. After 900 measurements, the instrument issues a reminder for clearing the memory. If the memory is full, no measurements are possible and in that case no more measuring results will be saved, so make sure to free memory space in time.

To avoid reminders and the necessity of deleting data manually, you can set the data memory to behave as a circular buffer if you use the instrument in low security mode.

- Tap <Menu> and select **"Setup > Expert Settings > Data Memory Settings"** and activate the check box "Automatically delete old measurement data".

  The oldest 100 measurement results will then be automatically deleted as soon as the number of 900 measuring results has been exceeded in the data memory.

15.2 Defining Data Columns for the Data Browser

You can define the kind of data which shall be displayed in the data browser. You can change these settings any time and add further sample parameters to the result data files.

To set data for data browser display

1. Tap <Menu> and select **"Setup > Data Browser Settings"**.

2. Tap on the list item that you want to change or on the empty field at the bottom of the list if you want to add an item.

The row is highlighted.

3. Tap on the highlighted list item to get to the "Change Quantity" dialog.
4. Use the drop-down boxes to define the "Group", "Quantity", "Unit" and the number of "Digits".
5. Tap <OK>.

To change the sequence of the data

1. Tap <Menu> and select **"Setup > Data Browser Settings"**.
2. Highlight a list item and use the up/down arrows in the right column to change the position of the list item in the favorites list.

   This results in changing the sequence of the columns in the data browser.
3. Proceed so with all other list items whose position you want to change and tap <OK>.

15.3 Viewing Results

Your instrument supports two forms of result visualization:

- In the multiple sample view you can see a number of results listed in a table.
- In the single sample view you can see a more detailed view of one result at a time.

In the multiple sample view, the output quantities according to the data browser settings are displayed. In the single sample view, the output quantities according to the result output settings are displayed.

If no output quantities have been selected in the result output settings or if the measuring method of a sample has been deleted, the data browser settings are also used for the single sample view, printouts and data exports.

Multiple sample view

1. Tap <Menu> and select **"Data Memory > Measured Data"** to open the multiple sample view.
2. Use the two scrollbars to scroll vertically and horizontally.

Single sample view

1. In the multiple sample view, highlight the sample that you want to see in more detail.
2. Tap <Single Sample> to open the single sample view.

3. Use the <▲> or <▼> button to see the previous or next result.

15.4 Filtering Results

With the filter tool, you can reduce the number of measuring results in the multiple and in the single sample view.

Filter settings can be defined separately:

- for printing, exporting and viewing of measured data
- for deleting measured data

Subsequent actions as printing, exporting, deleting, only apply to the data corresponding with the filter criteria.

Filter criteria

- Date
- Date range
- Sample Name
- Method (only available if previously used)
- User-defined data fields
- Print/Export Status
- Sample Error State
- User (only those who performed measurements are available)
- Magazine pos.
- Measuring value
- Master Condition (Quantity)
- Camera image available
- Electronic Signature

Comparators

- older than
- newer than
- equals
- not equal
- larger than
- smaller than
- containing
- not containing
- printed/exported
- not printed/exported

Different filter criteria are linked to each other using an AND relation.

To define a filter

1. In the multiple sample view, tap <Filter> to open the "Filter" dialog.

2. Define one or more filter criteria in the first column "Filter criterion":

3. Select an available "Comparator" and assign a "Value" to the filter criteria.

4. Tap <OK> to get back to the multiple sample view.

   The multiple sample view and the single sample view now only show those results that meet your filter criteria.

Examples:

- If you only want to see the samples that were measured with the method "°Brix", choose the following settings:
  - Filter criterion: "Method"
  - Comparator: "equals"
  - Value: "° Brix"
- If you only want to see the samples that have not been exported yet, choose the following settings:
  - Filter criterion: "Print/Export Status"
  - Comparator: "not printed/exported"
- If you only want to see the samples that have been measured during the last week, choose the following settings:
  - Filter criterion: "Date range"
  - Comparator: "equals"
  - Value: "Last Week"

To delete a filter

1. In the multiple sample view, tap <Filter> to open the "Filter" dialog.
2. Highlight the filter that you want to delete and tap <Delete>.

15.5 Viewing Statistics

Statistical numbers are always calculated according to the filter settings of the measured data in the data browser.

Statistical details will only be calculated for those quantities which are activated for the result output of the respective measuring method (see Chapter 12.2.3).

Results from checks and/or temperature scans are not included in any statistical analysis.

1. Tap <Menu> and select **"Data Memory > Statistic"** to open the statistics overview.

   A table of methods and their respective number of result output quantities is displayed.

2. Highlight a row.
3. Tap <Statistic Details>.

4. For each output quantity the following statistics are displayed:

No. of Values	Number of measurements
Minimum	Lowest value
Maximum	Highest value
Average	Arithmetic mean value
StdDev	Standard deviation

15.6 Printing and Exporting Results and Other Data

Your instrument supports three kinds of printouts:

- Simple continuous printouts using an RS-232 printer with paper roll
- Report printouts using an office printer (USB or local network)
- Report printouts to PDF files (USB flash drive)

Your instrument supports the export of data in the data formats MS Excel (.xls) and MS Text Editor (.txt).

You can printout and export measured data, check data, adjustment data, statistics, audit trails, etc.

To print data

1. Tap <Print or Export> and select **"Print Report (Paper/PDF File)"**.

2. Tap <OK> to open the "Print Report" dialog.

3. Use the drop-down boxes "Target", "Report" and "Drive" and the input box "File Name" to define the printout settings and tap <OK>.

   Exported PDF files are password-protected.

To export data

1. Insert a USB flash drive into a USB interface.

2. Tap <Print or Export> and select **"Export Data (Excel File/Text File)"**.

3. Tap <OK> to open the "File Export" dialog.

4. Use the drop-down box "File Format" to select "Excel" or "Text", define the "Drive" and enter the "File Name", then tap <OK>.

   The measuring results are exported according to your current filter settings (see Chapter 15.3). For each method those data are exported which are defined in the **"Result Output"** menu.

Related topics

Filtering Results: Chapter 15.4
Activating/Deactivating an Automatic Printout: Chapter 10.2.3
Creating, Editing and Deleting Printer Report Layouts: Chapter 10.2.1
Defining Header and Background of the Printer Report: Chapter 10.2.2
Registering, Editing, Deleting a Printer: Chapter 9.3.2
Defining the Result Output: Chapter 12.2.3

15.7 Deleting Results

We recommend deleting your result data regularly after a successful data export or printout.

To delete a single result

1. Tap <Menu> and select **"Data Memory > Delete Measured Data"**.
2. Highlight a row in the multiple sample view.
3. Tap <Single Sample> and tap <Delete Entry>.

To delete several results

1. Tap <Menu> and select **"Data Memory > Delete Measured Data"** to open the multiple sample view (delete).
2. Tap <Filter> to change the number of results to be deleted (see Chapter 15.4).
3. Tap <Delete All> to delete the filtered data.

16 Using Special Functions

16.1 System Security

You can enable different system security settings to ensure data security and to protect your measuring system from unauthorized access.

16.1.1 Security Level

Depending on your needs you can set different security levels: low or 21 CFR Part 11 compliant. The "Low" security level is set by default.

If any changes are applied to one of the standard security level settings (see Table 16.1), the security level is switched to user-defined security level.

Table 16.1: Comparison of security level settings

Security Level	**Low**	**21 CFR Part 11**
Audit Trail	Off	On
Audit Trail Backup Reminder	-	Default: 7 days
Electronic Signature	Off	On
E-Sign requires password	-	On if activated
Auto Logoff	Off	On
Auto Logoff Time	-	Default: 60 min
Password Expires	Off	On
Password Expiry Time	-	Default: 60 days
Increased Security	Off	On

To view the security settings

1. Tap <Menu> and select **"Setup > System Security > Security Level"**.

2. To check your current settings, tap <Details>.

To set the security level

NOTICE

- Your current sample list will be reset by changing the security level.
- By activating "21 CFR Part 11", increased security is activated automatically (see Chapter 16.1.3).

---

1. Tap <Menu> and select **"Setup > System Security > Security Level"**.

2. Use the drop-down box to select a security level.

   The user-defined security level is only visible and can be selected if the user has changed any default security settings.

3. If you want to compare your current settings and the settings that will be affected by changing the security level, tap <Details>.

   The settings affected by changing the security level will be highlighted with red letters.

4. Tap <OK> to set the security level.

16.1.2 Auto Logoff and Password Expiry

To set an auto logoff time

You can set the instrument to automatically log off the current user after a defined time of inactivity.

1. Tap <Menu> and select **"Setup > System Security > Logon Settings"**.
2. Use the check box to activate or deactivate the auto logoff function.
3. Set the auto logoff time to a time between 1 and 60 min.

To set password expiry

You can define how long passwords are valid. The setting applies to all passwords. If a password expires, the corresponding user account is deactivated.

For activating a user account and setting a password, see Chapter 10.4.2.

1. Tap <Menu> and select **"Setup > System Security > Logon Settings"**.
2. Use the check box to activate the password expiry function.
3. Set the password expiry time to a time between 1 and 60 days.

16.1.3 Increased Security

In addition to different security levels (see Chapter 16.1.1), you can tighten your security settings by activating increased security settings.

NOTICE
If the increased security is activated, all user accounts that do not comply with the naming rules or password rules will be deactivated. The auto logon function will be deactivated if set.

Table 16.2: Increased security settings

On	Off
No endless data storage allowed	Endless data storage allowed
Only user-defined sample list mode allowed	All sample list types allowed
Lock user account after three failed logon attempts	User account is not locked after failed logon attempts
Auto Logon is not allowed	Auto Logon allowed
User name must have at least 6 characters	User name can be shorter than 6 characters
User name must be entered instead of selected from list	User name can be selected from list
Password must have at least 6 characters	Passwords can have any length
Last 5 passwords must not be used	Same passwords can be used

To activate or deactivate increased security

1. Tap <Menu> and select **"Setup > System Security > Increased Security"**.
2. If you want to view your current settings, tap <Details>.
3. Use the "Increased Security" check box to activate or deactivate increased security.
4. If you want to view the settings that will be affected by activating increased security, tap <Details>.
5. Tap <OK> to save the setting.

16.1.4 Audit Trail

Using the audit trail function, you get all operating steps that directly or indirectly lead to changes in measuring results documented in a log file. Additionally all changes which are relevant for data integrity, manipulation or access control are documented in a log file as well.

The following operations including the respective warnings which appear in the diagnosis window are documented in the audit trail:

- Successful or rejected adjustments and passed or failed checks
- Resetting of adjustments to factory adjustment
- Exceeding of adjustment intervals and check intervals
- Changes of methods via settings in the density module
- Changes in customer functions

- Changes of user accounts (creating, editing, activating, deactivating, deleting, changing a password)
- Saving and restoring of parameter settings and configurations
- Deletion of measured data (number of deleted measuring data and corresponding unique sample ID)
- Changes in the instrument firmware, module firmware and operating system
- Changes in the setup of the measuring system (mounting or dismounting modules)
- Activation or deactivation of the audit trail function and exporting/deletion of audit trail entries
- Changes to the instrument date and time

If you are working under QM regulations like GLP/GMP or 21 CFR part 11, we recommend you set your security level to 21 CFR part 11 or a user-defined security level where audit trail is active. Export the audit trail data in regular intervals and store the data in a safe place.

To activate/deactivate audit trail

There are two ways to activate the audit trail function:

- You can set the security level to "21 CFR Part 11" (see Chapter 16.1.1) and audit trail will be activated automatically.
- You can activate the audit trail function within your user-defined security mode.

1. Tap <Menu> and select **"Setup > System Security > Audit Trail"** to open the "Audit Trail Settings" dialog.

2. Activate/deactivate the audit trail using the check box "Audit Trail active".

3. Activate/deactivate the "Backup Reminder", define the time span and tap <OK>.

To view, print or export the audit trail

The audit trail list can store up to 999 entries. Make sure to regularly export and delete the audit trail data.

1. Tap <Menu> and select **"Data Memory > Audit Trail"** to open the audit trail list.

2. Highlight a list item and tap <Single Entry> to see more detailed information.

3. To perform a printout on paper or to a PDF file or to export the data as an MS Excel or text file, tap <Print or Export> and follow the instructions on the screen.

To delete the audit trail entries

1. Tap <Menu> and select **"Data Memory > Delete Audit Trail"**.

2. Tap <OK>.

All audit trail entries that have already been exported are deleted.

For data safety reasons, it is not possible to delete audit trail entries that have not been exported before.

Verifying the integrity of audit trail exports

Audit trail data exports are protected by a MD5 checksum file that is exported together with the data file to guarantee full traceability.

After successful export of the data file and the corresponding md5 file, a new audit trail entry including the MD5 checksum (hash) is generated. This checksum can be compared with the checksum of the exported file at any time to confirm that the exported file was not manipulated.

To generate an MD5 checksum

Any MD5 checksum program can be used.

Example: Using the program "md5summer.exe" that can freely be downloaded from www.md5summer.org/download.html.

1. On your PC, start "md5summer.exe".
2. When asked "please select the root folder", select the directory where the log files (the .md5 file and .xls or .txt file) are saved and click <Verify sums>.
3. In the following dialog, select the .md5 file that you want to check and click <Open>.

   The check status and result are displayed.

   If the checksum (hash) is the same as in the corresponding DMA M audit trail entry, the export file has not been manipulated.
4. Quit the program by clicking on <Close>.

16.1.5 Electronic Signature

Electronic signatures can be classified as ordinary manual signatures to help within the authenticity of electronic data in regulated process environments.

Roles for the electronic signature

Depending on importance or impact, different signing roles can be assigned to a user. According to common regulations, you can choose between three different roles: submitter, reviewer or approver.

Once the electronic signature function has been activated, a sample can be signed as positive or negative by the submitter, followed by the reviewer and finally by the approver. If a user of a higher level signs first, the signing states of the lower levels are set according to the evaluation of this higher level user.

Example: If a sample is signed as positive by the approver prior to a submitter or reviewer, the signing states of submitter and reviewer are also set as positive consequently.

Signing states

With the electronic signature activated, three boxes appear in the first column of the data table in the multiple sample view next to the sample error state icon. The boxes illustrate the signing states of submitter (bottom box), reviewer (middle box) and approver (top box):

- grey box: not signed yet
- green box: signed as positive
- red box: signed as negative

To set the electronic signature

1. Tap <Menu> and select **"Menu > Setup > System Security > Electronic Signature"**.
2. Use the "Electronic Signature" check box to activate or deactivate the electronic signature.
3. If a password is required during the signing process, use the second check box to activate a password inquiry (for setting a password, see Chapter 10.4.2).
4. Tap <OK>.

To assign the role for the electronic signature

1. Tap <Menu> and select **"Setup > User Management"**.
2. Highlight the user to whom an electronic signature role shall be assigned.
3. Tap <Edit>.
4. Use the "Role for Electronic Signature" drop-down box to specify the role for electronic signature.
5. Tap <OK>.

To execute the electronic signature for a sample

Only the user who carried out the measurement is allowed to sign the corresponding sample as the submitter.

NOTICE
Once you have executed electronic signature, you can no longer change the signing state of the respective sample.

1. Tap <Menu> and select **"Data Memory > Measured Data"**.
2. Highlight the sample that shall be signed.
3. Change to the single sample view by tapping <Single Sample>.
4. Tap the corresponding signing role button.
5. If needed, add a comment using the input field.
6. Enter your password if inquired.
7. Assess the sample by tapping <Sign negative> or <Sign positive>.
8. If you want to print or export your results including signing state and respective comments, tap <Print or Export>.

16.2 User Functions - Constants, Formulas, Polynomials and Tables

With user functions, you can automatically calculate quantities of your interest from the output values of your instrument. For the calculated quantities, you have the same options for display, printout and export as for standard measurement results.

Examples:

- Calculate the concentration of binary mixtures from the density of the mixture.
- Convert your results into a unit which is not supported in the standard instrument configuration.

There are six types of user functions: constants, formulas, linear functions, polynomials with one input value (1 D), polynomials with two input values (2 D) and user tables.

You can program up to 20 user functions.

Cascading user functions

You can freely use the output value of one user function as the input variable for another user function independently of the types of user functions involved. The instrument firmware automatically checks for circularity of the formula system.

Displaying user functions in output fields

To select an output quantity from the group "User Functions" for the display, see Chapter 12.2.2.

Output fields displaying custom functions feature the user symbol in the upper left corner of the output field. A maximum of 20 characters of the user function’s name can be displayed.

To program or edit a constant

The "Constant" user function is used to integrate a user-defined value to the result output.

The constant can describe every quantity needed and does not need to be directly measured with your measuring system. The constant can be also be integrated in other user functions or changed if needed.

The constant has to be activated in the method settings of the desired methods. Then a value for the constant can be set in the method settings of the respective methods or in the sample settings via the quick settings function.

1. Tap <Menu> and select **"Setup > Expert Settings > User Function Management"** to open the user functions list.

2. Tap <New> to program a new constant or highlight a list item and tap <Edit> to edit a constant.

   The four-step "User Function" wizard opens.

3. Perform the following settings:

   - Enter a name for the constant (up to 50 characters long).
   - Use the drop-down box "Function Type" to select "Constant".
   - Use the drop-down box "Physical Quantity" to select the type of quantity you want to use.
   - Use the drop-down box "Unit" to select the output unit.

4. Tap <Next>.

   - Activate/deactivate the check box "Protect function against changes by other users".
   - Enter a comment to describe this user function.

   This comment will not be printed, exported or displayed anywhere but is only an internal description of your user function.

5. Tap <Next>.

   A message is displayed to inform you in which menu you can set the value for the constant and in which menu you can activate the user function.

6. Tap <OK> to save the "Constant" user function.

7. To activate the constant in the desired methods, tap <Menu> and select **"Methods > Method Settings > "Method name" > Activate Modules / Constants"**.

8. Highlight your constant user function, enable the check box and tap <OK>.

   The constant is automatically added to the quick settings parameters.

9. To enter a value for the constant, use the quick settings function in the sample list or the menu **"Formula Parameters"** in the method settings.

To program or edit a formula

1. Tap <Menu> and select **"Setup > Expert Settings > User Function Management"** to open the user functions list.

2. Tap <New> to program a new formula or highlight a list item and tap <Edit> to edit a formula.

   The four-step "User Function" wizard opens.

3. Perform the following settings:

   - Enter a name for the formula (up to 50 characters long).
   - Use the drop-down box "Function Type" to select "Formula".
   - Use the drop-down box "Physical Quantity" to select the type of quantity you want to calculate.
   - Use the drop-down box "Unit" to select the output unit.

4. Tap <Next>.

   - Activate/deactivate the check box "Protect function against changes by other users".
   - Enter a comment to describe this user function.

   This comment will not be printed, exported or displayed anywhere but is only an internal description of your user function.

5. Tap <Next>.

   - Enter a "Name" for the first variable and define the input quantity.
   - Do the same for further input quantities if required.

6. Tap <Next>.

7. Enter your formula and tap <OK>.

TIP *Only the operators () + - / * ^ and constants are allowed.*

To program or edit a linear function

1. Tap <Menu> and select **"Setup > Expert Settings > User Function Management"** to open the user functions list.

2. Tap <New> to program a new linear function or highlight an existing linear function and tap <Edit> to open the four-step "User Function" wizard.

3. Perform the following settings:

   - Enter a name for the linear function (up to 50 characters long).
   - Use the drop-down box "Function Type" to select "Linear Function".
   - Use the drop-down box "Physical Quantity" to select the type of quantity you want to calculate.
   - Use the drop-down box "Unit" to select the output unit.

4. Tap <Next>.

- Activate/deactivate the check box "Protect function against changes by other users".
- Enter a comment to describe this user function.

  This comment will not be printed, exported or displayed anywhere but is only an internal description of your user function.

5. Tap <Next>.

6. Define the input quantity and tap <Next>.

7. Enter "Offset" and "Factor" for your linear function and tap <OK>.

To program or edit a polynomial (one- or two-dimensional)

The general formula for a one-dimensional polynomial is:

$f(x) = coeff0 + coeff1 * x + coeff2 * x^2 + coeff3 * x^3 + coeff4 * x^4$

x ..... selected input quantity
f(x) ... calculated output quantity

The general formula for a two-dimensional polynomial is:

$f(x) = Coeff00 + Coeff01 * y + Coeff02 * y^2 + Coeff03 * y^3 + Coeff10 * x + Coeff11 * x * y + Coeff12 * x * y^2 + Coeff20 * x^2 + Coeff21 * x^2 * y + Coeff30 * x^3$

x ..... selected first input quantity
y ..... selected second input quantity
f(x,y) ... calculated output quantity

1. Tap <Menu> and select **"Setup > Expert Settings > User Function Management"** to open the user functions list.

2. Tap <New> to program a new polynomial or highlight an existing polynomial and tap <Edit> to open the four-step "User Function" wizard.

3. Perform the following settings:

   - Enter a name for the polynomial (up to 50 characters long).
   - Use the drop-down box "Function Type" to select the polynomial type.
   - Use the drop-down box "Physical Quantity" to select the type of quantity you want to calculate.
   - Use the drop-down box "Unit" to select the output unit.

4. Tap <Next>.

   - Activate/deactivate the check box "Protect function against changes by other users".
   - Enter a comment to describe this user function.

   This comment will not be printed, exported or displayed anywhere but is only an internal description of your user function.

5. Tap <Next>.

6. Define the input quantity/quantities and tap <Next>.

7. Enter the polynomial coefficients.

   If you do not enter a value for a coefficient, the coefficient will be set to the value zero.

8. Tap <OK>.

To program or edit a user table

If you have a literature table or own experimental data about the density of a binary mixture at different concentrations, you can program this data into a user table.

TIP

- *The larger the number of data pairs and the higher the accuracy of the data pairs, the higher the accuracy of the results that you can obtain with your user table.*
- *Your M series instrument will interpolate, but not extrapolate. This means, that the data pairs that you enter into the instrument should cover the whole range of values that you want to measure.*

1. Tap <Menu> and select **"Setup > Expert Settings > User Function Management"** to open the user functions list.

2. Tap <New> to program a new user table or highlight an existing user table and tap <Edit> to open the four-step "User Function" wizard.

3. Perform the following settings:

   - Enter a name for the user table (up to 50 characters long).
   - Use the drop-down box "Function Type" to select "Table".
   - Use the drop-down box "Physical Quantity" to select the type of quantity you want to calculate.
   - Use the drop-down box "Unit" to select the output unit.

4. Tap <Next>.

   - Activate/deactivate the check box "Protect function against changes by other users".
   - Enter a comment to describe this user function.

   This comment will not be printed, exported or displayed anywhere but is only an internal description of your user function.

5. Tap <Next>.

6. Define the input quantity and tap <Next>.

7. Enter the values of the table and tap <OK>.

To verify a user function

You can directly check the output of your user function when you have finished the programming.

Tap <Save and Try> at the last step of the "User Function" wizard (Step 4 of 4) to save the user function and to automatically switch to the calculator (see Chapter 16.3).

To copy a write-protected user function

If you want to change a user function that has been created by another user and has been write-protected, you can copy the user function and save the changes in the copy.

1. Tap <Menu> and select **"Setup > Expert Settings > User Function Management"** to open the user functions list.

2. Highlight the write-protected user function and tap <Edit>.

3. Choose one of the displayed options:

   - Tap <Yes> to make a copy of this user function and save your changes under a different name.
   - Tap <No> to open this function in read-only mode.

To delete a user function

1. Tap <Menu> and select **"Setup > Expert Settings > User Function Management"** to open the user functions list.

2. Highlight a list item and tap <Delete>.

16.3 Calculator

With the calculator, you can simulate any factory predefined function or any of your own user functions. You can enter an input value and check which output value the function will generate. You can also generate a graph within a defined range for the selected function.

Examples:

- You have programmed a user function and want to verify if it works properly.
- You want to check the output of the factory predefined function "Ethanol OIML-ITS-90 % v/v" for some density values of your interest.

To perform a calculation

1. Tap <Menu> and select **"Setup > Expert Settings > Calculator"** to open the calculator.

2. Use the drop-down boxes to select the "Function" and the output "Unit" and tap <OK>.
3. Select **"Manual Value Input (Calculator)"** and tap <OK>.
4. Enter the "Value" for the input parameter(s) and tap <Next>.
5. Read out the result of the function.
6. To calculate further results with other values, tap <Previous> and repeat steps 4 and 5.
7. To exit the calculator, tap <OK>.

To generate a graph

1. Tap <Menu> and select **"Setup > Expert Settings > Calculator"** to open the calculator.
2. Use the drop-down boxes to select the "Function" and the output "Unit" and tap <OK>.
3. Select **"Data Diagram"** and tap <OK>.
4. Activate the check box in the column "Select" for the variable quantity (in case more than two quantities are available).
5. Enter a "Value" for the constant input parameter which has not been activated in column "Select" and tap <Next>.
6. Define the range for the x axis (variable input quantity) by entering the "First Value" and the "Last Value" for the variable quantity.

   The graph is displayed and can be printed out or exported by tapping <Print or Export>.

   Graphs cannot be printed by RS-232 printers with paper roll.
7. To calculate further results with other values, tap <Previous> and repeat steps 4 to 6.
8. To exit the calculator, tap <OK>.

16.4 Group Calculator

With the group calculator, you can simulate all calculations belonging to a certain group in one step. Enter the corresponding input values to get all output values belonging to the group.

To perform a calculation

1. Tap <Menu> and select **"Setup > Expert Settings > Group Calculator"**.

2. Use the drop-down box "Group", select the type and tap <Next>.

3. Enter the "Values" for the Input Quantities and tap <Next>.

4. Read out the calculated results.

5. To calculate further results with other values, tap <Previous> and repeat steps 3 and 4.

6. To exit the calculator, tap <OK>.

17 Service Utilities

In this chapter, you can find information about making a backup/restore of your instrument settings, performing a firmware upgrade, getting details about the system and viewing the live raw data.

17.1 Making a Backup of the Instrument Settings

You can use this utility for:

- Saving the current instrument status including all method settings and your favorites list for safety reasons for the case that someone changes the settings accidentally.
- Saving the current settings before you perform a firmware upgrade.
- Copying the instrument settings to one or more other M series DMA instruments.

A backup file contains the following instrument settings and instrument information:

- Global settings in the control panel (regional settings, keyboard settings, network settings)
- Method settings (display layout and content, result output settings, limit settings, module settings, check definitions)
- User functions
- Users
- System settings (instrument settings, global module settings, sample list settings, audit trail settings, printout settings)
- Adjustments (special adjustments, adjustment data)

To make a backup of instrument settings

1. Tap <Menu> and select **"Service > Backup Instrument Settings"** to open the "Backup" dialog.

2. Select the data storage location (USB flash drive) and enter a "file name" or accept the automatic file name.

3. Tap <Next>.

4. Select the content of your backup file in the column "Value" and tap <OK>.
5. Tap <Yes> to create your backup file.

   The backup file is stored into the root directory of your USB flash drive.

17.2 Restoring Instrument Settings

For version 1.70 and higher, you can restore any backup file made with version 1.60 or higher.

NOTICE
For instruments with firmware version 1.60 installed it is not possible to restore backups made with older firmware versions.

NOTICE
When restoring the instrument settings, make sure that the backup file corresponds with the instrument type.

1. Tap <Menu> and select **"Service > Restore Instrument Settings"** to open the "Restore" dialog.
2. Tap <Details> to scan the content of the selected backup file.
3. Select the location of your backup (USB flash drive) and the "file name" using the two drop-down boxes.

   The backup file must be stored in the root directory of your USB flash drive.
4. Tap <Next>.
5. Select the settings to be restored to your instrument in the column "Value" and tap <OK>.
6. Tap <Yes> to restore the settings.
7. Follow the instructions on the screen.

17.3 Updating the Firmware

Generally, it is only necessary to update the user interface firmware. This sets up the instrument with the new features of the latest firmware version containing the module firmware.

NOTICE
To update the firmware, you need administrator rights with activated auto logon function (see Chapter 10.4.2).

TIP *Before starting the update of the user interface firmware, export or print relevant measurement data (see Chapter 15.6) and create a backup of the instrument settings (see Chapter 17.1).*

TIP *For the new instruction manual, select the respective product page on www.anton-paar.com and send a download request (under the entry **Manuals** in the **Downloads** tab).*

To update the user interface firmware

1. Load the latest firmware into the root directory of your USB flash drive.
2. Insert the USB flash drive into a USB interface of your instrument.
3. Tap <Menu> and select **"Service > Update > User Interface Firmware"**.
4. Select the location (USB flash drive) and the "file name" of the new firmware.
5. Tap <Update>.
6. Follow the instructions on the screen.
7. Restore the instrument settings (see Chapter 17.2).

To update the module firmware

TIP *A diagnosis message is shown if a too old firmware is installed on one of your modules. If the auto logon for a user with administrator rights is activated, the firmware update of the module can be started. Otherwise, the administrator must log on and then start the firmware update (menu **"Service > Update > Module Firmware"**).*

1. Load the latest firmware into the root directory of your USB flash drive.
2. Insert the USB flash drive into a USB interface of your instrument.
3. Tap <Menu> and select **"Service > Update > Module Firmware"**.
4. Select the location (USB flash drive) and file name of the new firmware or select "Internal" and tap <Update>.

   If you select "Internal", the instrument automatically checks the system. In case any modules run an older firmware version, the instrument will update it to the version supported by the user interface firmware. No USB flash drive is required in that case.

5. Follow the instructions on the screen.

To install a language pack

To receive a language pack, contact your Anton Paar representative.

1. Load the desired language pack into the root directory of your USB flash drive.
2. Insert the USB flash drive into a USB interface of your instrument.
3. Tap <Menu> and select **"Service > Update > Install Language Pack"**.
4. Select the location (USB flash drive) and file name of the language pack and tap <Update>.
5. Follow the instructions on the screen.

17.4 Viewing the System Information

In this menu, you find information about the configuration of the hardware and firmware including, if connected, Xsample filling equipment and external measuring modules. The instrument type, serial number and firmware versions are shown in a table.

In this menu, you can also save an instrument log file to a USB flash drive. This file contains the last operating steps and may help during trouble shooting.

To view hardware and firmware configuration

1. Tap <Menu> and select **"Service > System Information"** to open the configuration overview table.
2. Use the vertical scrollbar to scroll through the table.

To save the instrument log file

1. Tap <Menu> and select **"Service > System Information"** to open the configuration overview table.
2. Insert a USB flash drive into a USB interface and tap <Save Logfile>.
3. Accept the automatically generated file name or enter a new one and tap <OK>.

   The instrument log file is now saved to the root directory of the USB flash drive.

To change the log file configuration

In special cases your Anton Paar representative will ask you to change the configuration of your log file in order to get more specific information about your instrument.

1. Tap <Menu> and select **"Service > Update > Logging Configuration"**.
2. Insert a USB flash drive with the special configuration file delivered by your Anton Paar representative into a USB interface.
3. Tap <OK>.
4. Save the instrument log file.

17.5 Viewing and Printing Live Raw Data

If the monitor mode is active, you get a live view of sensor signals including raw data in this menu. You can export or print the live raw data.

After a measurement is finished, the live raw data of the main measuring unit (e.g. "DMA Density") are frozen as well as the quantities on the main screen. To unfreeze the values, tap the button.

To view live raw data

- Tap <Menu> and select **"Service > Live Raw Data"**.

DMA Density

Quantities not mentioned in the following table are described in Appendix F (e.g. Density, Density Temperature, Density (not visc.-corr.) etc.).

dD Harmonic Value	Damping of the first harmonic.
Delta RHO Value	Difference between density calculated from 1st harmonic and density calculated from fundamental oscillation.
Density 1st Harmonic	Density calculated from the 1st harmonic of the U-tube.
Density Progress	Indicator (0-100) for the progress of the measurement.
e	Viscosity correction factor.
Fill Status	Status information about correct filling of the U-tube. Values different from zero indicate an incorrect filling.
RHO NC Harmonic Value	Not viscosity-corrected density calculated form the 1st harmonic.
RHO17 Value	Viscosity-corrected density, valid if the viscosity is less than 700 mPa·s.

RHOg5 Value	Viscosity corrected density, valid if the viscosity is greater than 500 mPa·s.
Status Value	Status information indicating the temperature status of the cell.

Calculations

You can view a list of the calculations of the currently available output quantities.

DCB - Air Pump

Air Pump State	Status of the air pump (0 or 1).

DMA Density - Air Pressure

Air Pressure	Currently measured air pressure.
Air Pressure Condition	Current status of the measurement.
Air Pressure State	Status of the air pressure measurement.
Air Pressure Substate	Detailed information about the status of the air pressure measurement.

DCB - Environment

Heatsink temperature	Temperature of the heat sink.
Room temperature	Temperature measured within the instrument.
NTC temperature	Temperature measured within the instrument.

DCB - CAN Connector

CAN Connector Current	Current measured at the CAN interface.

To print live raw data

1. Tap <Menu>, select **"Service > Live Raw Data"** and choose one of the groups of live raw data quantities.
2. To perform a printout on paper or to a PDF file, tap <Print or Export> and follow the instructions on the screen.

18 Communication with External PC and LIMS

18.1 Connecting the Instrument to an External PC via Ethernet

You can transfer the system information and a PDF file of the instruction manual from your instrument to any PC of your local network via Ethernet.

1. Connect the instrument to your local network via the Ethernet interface.
2. Tap <Menu> and select **"Setup > Control Panel > Network"**.
3. Activate the option "Obtain an IP address automatically (DHCP)" or enter the network parameters manually.

   For details about the network settings, see Chapter 10.1.6.
4. Open an internet browser on a PC that is connected to your local network.
5. Enter the IP address of your instrument in the address field of the browser and press the <↵> key.

   Now the system information of your instrument is displayed together with a download link for the PDF file of the instruction manual.

18.2 Connecting the Instrument to an External PC via RS-232

If you want to connect the DMA M to a PC (AP-SoftPrint) you have to use a certain cable and a gender changer. Please find below the Mat. No.:

1 pc. Mat. No. 70429	RS-232 connection cable
1 pc. Mat. No. 302592	Gender changer

Connecting the RS-232 cable

1. Connect the gender changer to the DMA M RS-232 connector at the rear.
2. Connect to the other end of the gender changer the RS-232 cable.
3. Connect the other end of the RS-232 cable to your PC.

   If you have no RS-232 connector at your PC, it is also possible to use a USB connector by using a USB/RS-232 converter.

You can operate the instrument using commands for the serial interface RS-232.

NOTICE
If you have defined an RS-232 printer, make sure that you do not print anything (manually or automatically) while using the RS-232 interface for data transfer to a PC. Otherwise, there will be a conflict with the RS-232 printer and both the printout and data transfer will fail.

Required RS-232 settings

- Baud rate: 9600
- Data bits: 8
- Stop bits: 1
- Parity: none
- Handshaking: none

Output format

- Language: always English
- Decimal separator: . (dot)
- Column separator: ; (semicolon)
- Line end: CR

RS-232 interface commands

Commands can be written with or without blanks between the words, for example both "getdata" and "get data" are valid commands.

The encoding is according to the 8-bit ANSI code page 850. This means that strings with special characters can only be converted with a loss of information. A "?" (question mark) will be used for characters which cannot be encoded.

The following interface commands are available to operate the instrument:

start or **start method_number** or **start method_number magazine_position**	Creates a new sample in the sample list and starts a measurement with the active method. Creates a new sample in the sample list and starts a measurement with the given method number. If an Xsample sample filling module is active and the sample list is in the user-defined mode, the magazine position is evaluated and set for the sample.
abort	Aborts the measurement.
getdatahead	Gets meta data of the last measured sample. The meta data contains the names of the output quantities of the last measured sample. The output quantities depend on the method and are set in the **"Result Output"** settings.

getdataunit	Gets unit data of the output quantities of the last measured sample. For each output quantity the unit is returned.
getdata	Returns the result values of the last measurement only once.
finished	Returns the status of the measurement.
getrawdata	Returns the current raw data values for "Density (not visc.-corr.)", "Density Temperature", "Set Temperature" and the "Unique Sample ID". The unique sample ID is "NaN" if no sample was measured yet.
getmethodname	Returns the name and number of the method.
getid	Returns the serial number, instrument type, firmware version and protocol version.
set temperature xx.xxx	Sets the set temperature of the current method to the given value (xx.xxx in [°C]). This command is only allowed, if no measurement is in progress.
help	Returns a list of the available RS-232 interface commands.

RS-232 commands and responses

Command	Response	Description
start or **start method_number** or **start method_number magazine_position**	measurement started	The command was accepted and the measurement was started.
	measurement already started	The measurement was already started.
	invalid method	The received start command did not contain a method number or the number could not be parsed.
	simple mode not supported	An Xsample sample filling equipment is active but the sample list is in the simple mode which is not supported. Change to the user-defined sample list mode.
	missing magazine position	An Xsample sample filling module is active and the sample list is in the user-defined mode but no magazine position parameter was received.

Command	Response	Description
start or **start method_number** or **start method_number magazine_position**	wrong magazine position	An Xsample sample filling module is active and the magazine position parameter is not valid (e.g. smaller than 1 or larger than the magazine size).
	sample storage full	The data memory and sample list are full. Clear the data memory and sample list or activate the automatic clearing option (see Chapter 15.1).
	heating	The Heating Attachment is heating, so no measurement can be started.
abort	measurement aborted	The measurement was aborted.
	measurement not started	No measurement was started.
	already aborting	The measurement is already being aborted.
getdatahead	Density;Specific Gravity;Density Temperature;Density Condition	Example response with the default settings.
	no data available	No measurement has yet been finished and so no data is available.
getdataunit	g/cm³;-;°C;-	Example response with the default settings.
	no data available	No measurement has yet been finished and so no data is available.
getdata	0.000892;0.000894;20.001;valid	Example response with the default settings.
	no new data available	No new measurement has yet been finished and so no new data is available.
finished	Measurement not started	No measurement has yet been started.
	Measurement not finished	The measurement is in progress now.
	Measurement finished	The measurement was finished.
getrawdata	1.102689;19.999;20.000:8	Example response.
getmethodname	method name: Density, 0	Example response.
getid	serial number: 80000000 DMA 4500M V1.70.6534.40 protocol version: 2.00	Example response.
set temperature xx.xxx	accepted	The command was accepted and the density temperature was set to the given value.
	wrong parameter value	The given value was not accepted (e.g. value is out of specifications).

Command	Response	Description
help	commands: • abort • start (method number) (magazine position) • finished • getdatahead • getdataunit • getdata • getrawdata • getmethodname • getid • set temperature xx.xxx • help	List of all available commands.

18.3 Connecting the Instrument to a LIMS

The instrument can be connected to your Laboratory Information Management System (LIMS) using the Anton Paar software LIMS Bridge. LIMS Bridge can be used to send remote measurement commands from the LIMS to the instrument and to forward result files from the instrument to the LIMS.

For more details, see the LIMS Bridge instruction manual.

Appendix A: Technical Data

A.1 Measuring Performance

Table A.1: Technical data of measuring performance

	DMA 4100 M	DMA 4500 M	DMA 5000 M
Measuring range	0 to 3 g/cm³		
Repeatability density (s. d.)	0.00005 g/cm³	0.00001 g/cm³	0.000001 g/cm³
Repeatability temperature (s. d.)[a]	0.02 °C	0.01 °C	0.001 °C
Measuring time[b]	approx. 30 sec.	approx. 30 sec.	approx. 40 sec.
Measuring temperature[c]	0 °C to 90 °C (32 to 194 °F) from DCB version 1.000.009: 0 °C to 95 °C (32 to 203 °F)		
Pressure range[d]	0 to 10 bar (0 to 145 psi)		
Sample volume	approx. 1 mL		
Ambient air pressure sensor	yes		
Full range viscosity correction	yes		
Reference oscillator	yes		
Automatic bubble detection	yes		
Visual check of the measuring cell	Inspection window	Camera	Camera

a. While the temperature repeatability is constant for the whole temperature range (from 0 °C to 95 °C), the temperature accuracy is not constant for the whole range. For temperatures above 90 °C, the temperature accuracy is typically between 0.01 °C and 0.05 °C.
b. After full temperature equilibrium
c. Cooling down further than 20 °C (68 °F) below ambient temperature only with external cooling using the cooling kit
d. For the measuring cell together with the injection adapters DMA/CarboQC (Mat. No. 19680) in the temperature range of 0 to 50 °C (32 to 122 °F). For temperatures higher than 50 °C (122 °F), the maximum allowed pressure is 5 bar (72.5 psi). See also Appendix C.2.

Table A.2: Typical accuracy[a] of concentration measurements (aqueous solutions, % w/w)

	DMA 4100 M	DMA 4500 M	DMA 5000 M
Ethanol	0.05	0.025	< 0.01
Extract/Sugar	0.025	0.015	< 0.01
HCl	0.02	0.01	< 0.01
NaOH	0.04	0.02	< 0.01
H_3PO_4	0.06	0.03	< 0.01
HNO_3	0.07	0.035	< 0.01
H_2SO_4	0.05	0.025	< 0.01

a. The accuracy is not the same over the whole concentration range. The values given are typical values for orientation purposes.

A.2 Wetted Parts

The following materials are in contact with samples and cleaning liquids:

DMA M

Material	Part
Borosilicate glass	Measuring cell
PTFE	Filling adapter

Standard accessories

Material	Part
Polyethylene	Waste vessel
Polypropylene/Polyethylene	Syringe 2 mL Luer
PTFE	Injection adapter Luer
PTFE	Male Luer plug PTFE
PTFE	Adapter Luer cone
Silicone	Hose 3 x 5 mm silicone

A.3 General Technical Data

Dimensions (L x W x H)	482 x 340 x 231 mm (19.0 x 13.4 x 9.1 in)
Weight	22.5 kg (49.6 lbs)
Voltage	AC 100 to 240 V, 50/60 Hz
Power	190 VA (incl. Xsample and external measuring module)
Power inlet	according to IEC/EN 60320-1/C14, protection class I
Fuses	Glass tube fuses 5 x 20 mm; IEC60127-2; AC 250 V; 5 A TH
Housing material	
Top & side cover	Aluminum, coated
Back	Aluminum
Front	Styrene/Butadiene
Environmental conditions (EN 61010)	Indoor use only
Ambient temperature	15 to 35 °C (59 to 95 °F)
Air humidity	10 to 90 % relative humidity, non-condensing
Pollution degree	2
Overvoltage category	II
Altitude	max. 3000 m (9800 ft)
Touch screen	6.4 in TFT, 640 x 480 px
Memory	• 512 MB SD-card (upgrade capability up to 8 GB) for internal information (logfiles and instrument settings) • from DCB version 1.000.009: SD-card is no longer used • 1000 measuring values with/without camera pictures
Interfaces	4 x USB (2.0 full speed), 2 x S-Bus, 1 x Ethernet (100 Mbit), 1 x CAN Bus, 1 x RS-232, 1 x VGA
RS-232 printer settings	Interface: RS-232 C; Baud rate: 9600; Parity: None; Stop bit: 1; Data bits: 8

WARNING

Serious injuries are possible through high voltage if the following hints are not adhered to.

- Only connect devices to the interfaces that comply with PELV (protective extra-low voltage) according to EN 61140 or with SELV (safety extra-low voltage) according to EN 60950.

NOTICE

Connect only Anton Paar equipment or equipment with a maximum power consumption of 40 W to the CAN interface.

Appendix B: Measuring Special Samples

B.1 Degassing Samples

There are different methods for the degassing of liquid samples. The preferable method for your application depends on the kind of sample and the amount of gas that is dissolved in the sample. Always take care that you treat all samples in the same way in order to get reproducible measuring results.

Be aware of the fact that you may change the composition of many samples slightly during the pretreatment due to evaporation of volatile components.

To boil the sample

1. Boil the liquid for several minutes to remove dissolved air.
2. Fill a clean glass flask full with the boiled liquid and cover it.
3. Wait until the liquid has cooled down to the approx. measuring temperature.

WARNING

Boiling of liquids may induce a risk of fire and/or a health hazard.

- Do not boil any flammable liquid because of a high risk of fire.
- If your sample contains volatile compounds that are toxic, always handle it in an appropriate environment like a fume hood, especially when you boil your sample.

To stir the sample

- Stir your sample vigorously for 2 to 15 minutes (depending on the stirring equipment) until no bubbling occurs any more.
- You can also pour the sample through a paper filter after stirring to get an even more efficient degassing effect.

To use an ultrasonic bath

- Put your sample for approximately 5 to 10 minutes into an ultrasonic bath until the bubble formation stops.

B.2 Special Filling Techniques

Bubbling samples

If the sample to be measured tends to form gas bubbles, degas it before the measurement (see Appendix B.1).

If this is not possible, introduce the sample at a temperature higher than the measuring temperature.

You can also put the density meter at a slight angle by means of proper spacers below the right side of the DMA M to allow the bubbles to escape due to buoyancy.

Suspensions and emulsions

Suspensions or emulsions may tend to separate in the measuring cells, giving incorrect results. Leave such samples in the measuring cell as briefly as possible. Prethermostat them before filling.

It may help to put spacers below the left legs of DMA M, thus putting it at an angle to counterbalance the separation force generated by the oscillation of the measuring cell.

Highly viscous samples

Highly viscous samples can be heated up to lower the viscosity. Always heat the sample to a temperature that is approx. 15 °C higher than the measuring temperature, which can be 90 °C maximum.

Pastes

Paste-like materials like toothpaste or tomato ketchup can be filled by syringe. Inject these kinds of samples into the measuring cell by pushing the plunger very slowly and continuously.

If the samples have a very high viscosity, you can fill them into the syringe by pulling the plunger completely out of the syringe, filling it from the back using a spoon and then mounting the plunger again.

Liquids in aerosol cans

For the quality control of aerosol cans, you can use the Anton Paar Aerosol Adapter (Mat. No. 74650) to fill the liquid safely and conveniently into your DMA M. For details, see the Aerosol Adapter instruction manual.

Gases

It is possible to measure gases with the DMA M. For details, contact your local Anton Paar representative and ask for the respective application report and the necessary accessories.

Appendix C: Measuring under Special Conditions

C.1 Measuring at High Humidity/Low Temperature Conditions

If the ambient air contains humidity and the measuring temperature is lower than the ambient temperature, condensation may occur in the measuring cell and measuring cell block.

Condensation in the measuring cell causes adjustment and measurement errors in DMA M series instruments and also in any RXA series instruments connected to them. Condensation in the measuring cell block damages the electronics and may lead to a failure of the U-view™ function (DMA 4500/5000 M). The higher the difference between the set measuring temperature and ambient temperature and the higher the air humidity, the easier condensation occurs.

To prevent condensation in the measuring cell

To prevent condensation in the measuring cell, use a drying cartridge (Mat. No. 65085) and connect it to the "DRY AIR IN AIR PUMP" connector at the rear of DMA M.

NOTICE

- Never connect hoses containing liquids or moist gases to the "DRY AIR IN AIR PUMP" connector as this may lead to condensations in the measuring cell and subsequently to measurement and adjustment errors.
- Operate the "DRY AIR IN AIR PUMP" connector only at ambient pressure.

Fig. C - 1 Drying cartridge connected

For a measuring temperature of 20 °C, a drying cartridge must be used under the following conditions:

Ambient temperature	Relative air humidity (r. h.)
20 °C	> 70 %
25 °C	> 50 %
30 °C	> 38 %

To prevent condensation in the measuring cell block

To prevent condensation in the measuring cell block, connect a dry air supply to the "DRY AIR IN BLOCK" connector at the rear of DMA M using a 3 x 5 mm hose made of suitable material (e.g. silicone) (see Fig. C - 1).

NOTICE
Never connect hoses containing liquids or moist gases to the "DRY AIR IN BLOCK" connector as this may lead to damage to the electronics.

The dry air supply must be used additionally to the drying cartridge if the measuring temperature is more than 5 °C lower than the ambient temperature. The following specifications of the applied air are required:

- 0.2 to 0.3 bar (2.9 to 4.4 psi)
- Class 5 from ISO 8573-1
- Max. particle size: 40 µm
- Max. pressure dew point: 10 °C below measuring temperature
- Max. oil content: 25 mg/m^3

To regenerate moist ruby gel

The drying cartridge contains beaded ruby gel, a non-toxic drying agent. When active, the color of the drying agent is red. Ruby gel which has absorbed liquid turns orange.

Moist ruby gel can be regenerated: Pour the ruby gel into a glass bowl and blow hot, dry air (max. 130 °C, 266 °F) through it for approx. 5 hours or place it in a laboratory oven for a few hours (or overnight) until it is red again.

NOTICE
Do not use higher drying temperatures than 130 °C (266 °F). Otherwise the indicator function of the ruby gel is spoiled.

C.2 Measuring at Low/High Temperatures

To measure at low temperatures

To perform measurements at temperatures lower than 20 °C (36 °F) below ambient temperature, install the cooling kit (Mat. No. 80810) and connect the DMA M to an external thermostat. If your tap water is cool enough also connecting to a tap water supply will help. Operate the cooling kit with a moderate flow of water (1 to 3 liters per minute).

Temperature range of the cooling unit	5 to 30 °C (41 to 86 °F)
Maximum pressure	1 bar (14.5 psi). For more details, see the cooling kit brief instructions.
Connector	Self-locking coupling 8 mm, Type Rectus 21KBTS08MVN, Mat. No. 75090

Example: Your ambient temperature is 25 °C (77 °F) and you want to perform measurements at 0 °C (32 °F). Install the cooling kit and connect the DMA M to an external thermostat or tap water line that is delivering water at a constant temperature between 5 °C to 15 °C (41 to 59 °F) and change the measuring temperature to 0 °C (32 °F) in the "Density Module" dialog.

To measure at high temperatures

NOTICE
At measuring temperatures of 50 °C (122 °F) and higher, the applied pressure must be limited to 5 bar (72.5 psi). Otherwise, the injection adapters may leak.

To prevent bubble formation

If you are measuring samples at temperatures significantly higher than ambient temperature, the tendency to form gas bubbles in the measuring cell will dramatically increase. To ensure precise results, you can:

- Degas your samples thoroughly directly before measuring (see Appendix B.1).
- Heat your samples up to a temperature significantly higher than the measuring temperature with stirring, directly before measuring.

To measure highly viscous samples at high temperatures

See Appendix B.2.

C.3 Measuring at High Pressures

The supplied silicone hose and injection adapters can only be used at atmospheric pressure. Before applying high pressures, exchange the supplied filling components with pressure-resistant components.

WARNING

Leaky components of the measuring system can cause sample to be splashed out when pressure is applied to the measuring system. Injuries and risk of fire possible.

To avoid injuries, do the following:

- At pressures higher than ambient pressure, only use the injection adapters DMA/CarboQC (Mat. No. 19680) and polyurethane hoses 2.5 x 4 mm (Mat. No. 15272),
- Before starting a measurement at high pressure, check the pressure tightness of the system with air.
- If you are measuring any aggressive, poisonous or flammable sample at high pressure, only use the smallest possible sample amount.

Adjustment with air and water

To reach the highest possible accuracy for high pressure measurements, perform the air adjustment as usual at ambient pressure and the water adjustment or an adjustment with any other reference liquid at the pressure at which you are going to perform the measurements.

C.4 Measuring in Harsh Environments

- Use the softkeys below the touch screen for operating the buttons in the lower area of the screen.
- Use a stylus or any convenient plastic stick with a soft and round ending to operate the touch screen.
- Use a PC mouse.

Protection foil

Your M series DMA is delivered with a transparent plastic protection foil covering the touch screen. Three spare protection foils can be ordered (Mat. No. 81402).

If the touch screen has become dirty, you can exchange the used protection foil against a new one.

To exchange the protection foil

1. Remove the used protection foil from the display using your finger nails.

2. Hold the new foil in one hand and use the thumb finger nail of the other hand to peel off the back liner from a small area.
3. Position the back liner free end of the foil on one edge of the display, hold the opposite end and bend the foil backwards.
4. Peel off the back liner with one hand, simultaneously rolling the foil slowly onto the display with the other hand.
5. Carefully flatten out the foil with a clean cotton cloth, pushing bubbles towards the edges.
6. In case of bubbles between foil and display, gently push them towards the edges or lift up the foil partly or completely and reapply the foil more slowly.

Appendix D: Adjusting the Camera Settings

D.1 Adjusting the Camera Position

If the camera does not show the complete measuring cell, you can adjust the position of the camera.

1. Log on as "administrator".
2. Tap the button in the quick access area.

   The camera window opens.

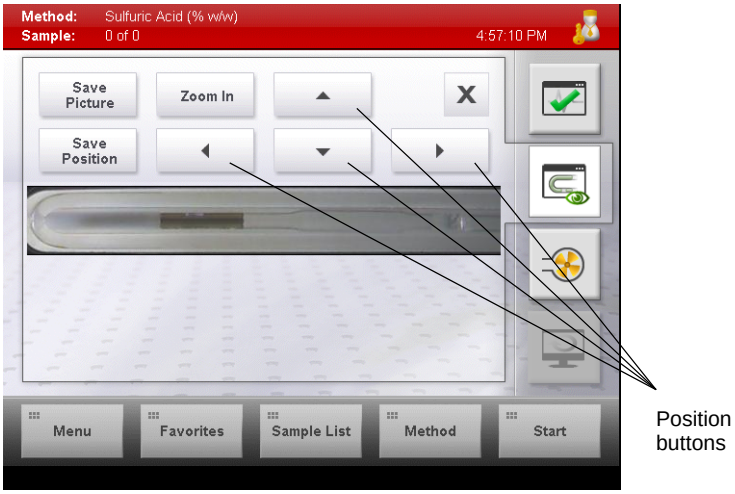


Fig. D - 1 Adjusting the camera position

3. Use the position buttons to accommodate the position of the camera.
4. To save the current camera position, tap <Save Position>.
5. Close the camera window by tapping <X>.

D.2 Setting the Camera Illumination

If the illumination of the camera picture is not suitable for your special environment, you can change the corresponding default setting.

1. Log on as "administrator".
2. Tap <Menu> and select **"Setup > Control Panel > Advanced Camera Settings"**.
3. Increase the value "Auto Exposure Luminance" to increase the brightness of the camera picture.

Appendix E: Trouble Shooting

Table E.1: Adjustment

Problem	Cause and Correction	See
Readjustment is necessary very often.	Bad water quality for checks/adjustments: Use freshly degassed ultra-pure (bi-distilled or deionized) water.	Chapter 11.3.1
	The measuring cell is not clean: Clean and dry the measuring cell perfectly before an air check/ adjustment.	Chapter 14
	The measuring cell is corroded by hydrofluoric acid, strongly alkaline solutions or mechanical abrasion: Do not leave glass-corroding liquids in the measuring cell.	Chapter 14
	Direct sunlight on the DMA: Install the DMA M at a place without direct sunlight.	Chapter 7.1
The adjustment is not finished after 10 minutes.	The measuring cell is not sufficiently dry for the air adjustment: Clean and dry the measuring cell perfectly before an air check/adjustment.	Chapter 14
	There are gas bubbles in the measuring cell during water adjustment: Repeat the filling procedure and use freshly degassed ultra-pure (bi-distilled or deionized) water.	Chapter 11.3.1

Table E.2: Measurement

Problem	Cause and Correction	See
I cannot start any measurement 15 minutes or more after booting the instrument.	Verify whether one or more modules are using older firmware versions than expected from the instrument's firmware. This information is either displayed at the start screen or in the diagnosis list of the quick access area. Tap <Menu> and select **"Service > Update > Module Firmware"** to update the respective modules using the internal firmware update package.	Chapter 17.3
Density Condition: "Filling Warning"	Gas bubbles in the measuring cell: Degas your sample. Fill the sample at higher temperature than the measuring temperature.	Appendix B.1
Density Condition: "Error: No Oscillation"	The measuring cell is only partly filled: Fill the sample again.	
Density Condition: "Timeout Error"	The sample is instable (e.g. emulsion): Prethermostat your sample.	Appendix B.2
	The timeout is set too short: Change the timeout setting.	Chapter 12.2.1

Table E.2: Measurement

Problem	Cause and Correction	See
The calibration failed. The results deviate from reference values.	Bad cleaning and drying: Improve your cleaning and drying procedure.	Chapter 14.1
	The calibration liquid was stored too long: Use a fresh calibration liquid.	
	Adjustment problems: Improve your adjustment routine.	Chapter 11.3.1
The measuring times during a temperature scan are varying.	The measuring times during temperature scans can vary due to internal temperature measurements and calibration after changing the temperature by a defined value.	

Table E.3: Touch screen

Problem	Cause and Correction	See
I do not hit the screen elements.	Bad touch screen calibration: Perform a new touch screen calibration.	Chapter 8.4

Table E.4: Data memory

Problem	Cause and Correction	See
I cannot see certain results in the data memory.	The filter function is activated and the results do not match the filter criteria: Change the filter settings.	Chapter 15.3
I have deleted all results but there are still results visible in the data memory.	The filter settings in the **"Delete Measured Data"** menu are different from the settings in the **"Data Browser Settings"** menu: Perform corresponding settings in both menus.	Chapter 15.7 and Chapter 17

Table E.5: Data export

Problem	Cause and Correction	See
The export to the USB flash drive does not work.	The USB flash drive has the old super floppy formatting and is therefore not accepted by the instrument: Reformat to hard disk type or try a newer USB flash drive.	
Wrong output data are exported.	The settings in the **"Result Output"** menu are wrong: Change the settings.	Chapter 12.2.3

Table E.6: Password protection

Problem	Cause and Correction	See
The instrument boots up without logon procedure and no password is requested.	A user with activated auto logon function was logged on the instrument before it was switched off: Tap on the user indicator icon and log on with another user account.	Chapter 10.4.2

Table E.7: Printout problems

Problem	**Cause and Correction**	**See**
No printout on office printer.	Office printer problems: Check if the printer has enough paper, toner etc. See the respective printer instruction manual.	
	The office printer type is not supported by your instrument.	Chapter 9.3
	Wrong interface used: Use the interface which was defined in the **"Printer Management"** menu or change the interface settings.	Chapter 9.3
	Wrong or no definition of the printer in the **"Printer Management"** menu: Change the definition.	Chapter 9.3
No printout on POS printer.	Printer problems: Check the printer. See the respective printer instruction manual.	
	Wrong or no definition of the printer in the **"Printer Management"** menu: Change the definition.	Chapter 9.3
	Chinese printer: Declare the printer as "RS-232 (Chinese)" in the **"Printer Management"** menu.	Chapter 9.3
The POS printer printout makes no sense.	Wrong communication settings on the POS printer: Change the DIP switch settings (see the printer instructions).	Appendix A.3
Wrong output values are printed.	The settings in the **"Result Output"** menu are wrong: Change the settings.	Chapter 12.2.3

Appendix F: List of Output Quantities

The following quantities can be selected as output for the output fields.

Group: System + Temperature Number of digits displayed with temperature values: DMA 5000 M: 3 DMA 4500 M: 2 DMA 4100 M: 2	
DataField 1	Name of the user-defined data field (optional sample ID).
DataField 2	Name of the user-defined data field (optional sample ID).
DataField 3	Name of the user-defined data field (optional sample ID).
Date	Current date.
Last Check Date	Date of the latest check.
Last Check Name	Name of the last check.
Last Check Result	Result of the latest check.
Last Check User	Name of the user who performed the latest check.
Master Condition	Sum of all available conditions from measuring modules within the system.
Measurement Type	Type of measurement defined in the sample list: S (Standard) C (Check) TS (Temperature scan) MM (Multiple measurement)
Method	Name of the selected or used method.
Sample Error State	Error messages concerning the sample: "No error", "Was canceled", etc.
Sample List Number	Number of the current sample list entry.
Sample Name	Name of the current sample.
Serial Number	Serial number of the instrument.
Sub Measurement Number	Measurement numbers within one single temperature scan performing several measurements at different temperatures
Time	Current time.
Unique Sample ID	Internal unique sample ID that cannot be reset.
User	Name of the user in a certain context.

Group: Density Number of digits displayed with density values: DMA 5000 M: 6 DMA 4500 M: 5 DMA 4100 M: 4	
Apparent Density Brass	Apparent density referring to scales which are adjusted with brass weights.
Apparent Density Steel	Apparent density referring to scales which are adjusted with steel weights.
Apparent Specific Gravity	Apparent density divided by the apparent density of water at the specified temperature. Apparent density is the weight in air (not mass!) divided by the volume.
Density	Value of viscosity-corrected true density.
Density (not visc.-corr.)	Density value without viscosity correction. The density is correct for samples with a viscosity at around 1 mPa·s (water). Noticeable high readings for samples of higher viscosity.
Density Temperature	Temperature in the measuring cell measured by the Pt 100 measuring sensor.
Density Condition	Current status of the measurement.
Density Control Temp.	Temperature in the cell block measured by the Pt 100 control sensor.
Density Set Temp.	Set measuring temperature.
Specific Gravity	Density of the sample at measuring temperature divided by the density of water at a measuring temperature.
Specific Gravity (not visc.-corr.)	Specific gravity without viscosity correction.
Specific Gravity t/04	Density of the sample at measuring temperature divided by the density of water at 4 °C.

Group: Density (Expert)	
d	Density number, calculated by subtracting the density of water from the measured density and dividing by the density of water at measuring temperature.
d (not visc.-corr.)	Density number without viscosity correction.

Group: Density (Expert)	
Damping	Damping represents the energy loss during oscillation caused by sample viscosity, and is used for viscosity correction of the density.
Last Air/Water Adjustment Date	Date of the latest air/water adjustment.
Last Air/Water Adjustment User	Name of the user who performed the latest air/water adjustment.
Periodic Time	Period of oscillation of the U-tube in the harmonic oscillation of 0th order.
Periodic Time 1st Harmonic	Period of oscillation of the U-tube in the harmonic oscillation of 1st order.
Periodic Time Ref. Oscillator	Actual period of oscillation of the reference oscillator.
PQ U-tube	Quotient of the period of oscillation of the U-tube divided by the period of oscillation of the reference oscillator.
PQ U-tube 1st Harmonic	Quotient of the period of oscillation of 1st order of the U-tube divided by the period of oscillation of the reference oscillator.

Group: User Functions User functions can be formulas, linear functions, polynomials (1D or 2D) or tables (see Chapter 16.2).

Group: Ethanol Tables Ethanol concentrations in percentage by volume (% v/v) or percentage by weight (% w/w) according to ethanol concentration tables issued by different organizations/authors. Number of digits displayed with ethanol values: DMA 5000 M: 3 DMA 4500 M: 2 DMA 4100 M: 2	
Canadian Excise Alcohol Table	Special ethanol table converting the output of a special adjustment into an ethanol value.
Ethanol AOAC 60 °F (% v/v)	Percentage by volume at 15.56 °C (60 °F), AOAC (American Organization of Analytical Chemists) tables, based on true density at 20 °C. The measuring temperature must be 20 °C (68 °F).
Ethanol AOAC 60 °F (% v/v) (not visc.-corr.)	Ethanol AOAC 60 °F (% v/v) without viscosity correction.
Ethanol HM C&E (% v/v) Ethanol HM C&E (% w/w)	HM C&E table at 20 °C.

Group: Ethanol Tables	
Ethanol IUPAC (% v/v) Ethanol IUPAC (% w/w)	Tables of the International Union of Pure and Applied Chemistry, based on true density at 20 °C. The measuring temperature has to be 20 °C (68 °F).
Ethanol Kaempf (% v/v) Ethanol Kaempf (% w/w)	Percentage by volume/weight according to W. KAEMPF, based on true density at 20 °C.
Ethanol OIML (% v/v) Ethanol OIML (% w/w)	According to the tables of the International Organisation of Legal Metrology (OIML), temperature according to ITS 68, based on true density at 20 °C.
Ethanol OIML-ITS-90 (% v/v) Ethanol OIML-ITS-90 (% w/w)	According to the tables of the International Organisation of Legal Metrology (OIML), temperature according to ITS 90, based on true density at 20 °C.
Ethanol Proof 60 °F	Proof degrees at 15.56 °C (60 °F), based on true density at 20 °C.
Ethanol Proof 60 °F (not visc.-corr.)	Ethanol Proof 60 °F without viscosity correction.

Group: Extract/Sugar Tables Concentration of extract/sugar (sucrose) of beverages in different concentration units. Number of digits displayed with concentration values: DMA 5000 M: 3 DMA 4500 M: 2 DMA 4100 M: 2 Number of digits displayed with Mass Concentration Sugar: All 3 models: 1	
Baumé	Based on specific gravity at set temperature (t). For liquids heavier than water °Be = (145 x SGt/t - 145) / SGt/t For liquids lighter than water °Be = (140 - 130 x SGt/t) / SGt/t
Concentration Sugar (°Balling)	Extract in percentage by weight, Balling table, based on true density at 20 °C.
Concentration Sugar (°Brix)	Sucrose in percentage by weight, NBS Table 113, based on true density at 20 °C.
Concentration Sugar (°Plato)	Extract in percentage by weight, Plato table, based on true density at 20 °C.
Mass Concentration Sugar	Sucrose in g/l, kg/m^3, vol.

Group: Acid/Base Tables Concentration of different aqueous acids and bases in percentage by weight (% w/w) and mole per liter (mol/l) according to different tables. Number of digits displayed with % w/w values: DMA 5000 M: 3 DMA 4500 M: 2 DMA 4100 M: 2 Number of digits displayed with mol/L and N values: DMA 5000 M: 4 DMA 4500 M: 3 DMA 4100 M: 3	
Hydrochloric Acid (HCl) (% w/w) (mol/l) (N)	Table of CRC Handbook of Chemistry and Physics, based on true density at 20 °C, range 0 to 40 % (0 to 21.5 mol/l). Accuracy approx. 0.02 % (0.01 mol/l).
Nitric Acid (HNO3) (% w/w) (mol/l) (N)	Landolt-Boernstein, based on true density at 20 °C, range 0 to 100 % (0 to 23.9 mol/l). Accuracy approx. 0.07 % (0.02 mol/l).
Phosphoric Acid (H3PO4) (% w/w) (mol/l) (N)	Landolt-Boernstein, based on true density at 20 °C, range 0 to 100 % (0 to 19.03 mol/l). Accuracy approx. 0.06 % (0.01mol/l).
Sodium Hydroxide (NaOH)[a] (% w/w) (mol/l) (N)	Landolt-Boernstein, based on true density at 20 °C, range 0 to 50 % (0 to 9.56 mol/l). Accuracy approx. 0.04 % (0.01 mol/l).
Sulfuric Acid (H2SO4) (% w/w) (mol/l) (N)	CRC Handbook of Chemistry and Physics, based on true density at 20 °C, range 0 to 94 % (0 to 17.6 mol/l). Accuracy approx. 0.05 % (0.01 mol/l).

a. Caution: corrodes measuring cell.

Group: API Functions The API functions automatically convert the density values of petroleum samples measured at any temperature to density, API gravity or specific gravity at 15 °C or 60 °F, according to ASTM D1250-08 and DIN 51757. Additionally, the same API functions are available for a reference temperature of 20 °C according to the "IP Petroleum Measurement Paper No. 3, 1988". The samples are divided into the groups crude oil (group A), fuel to heating oil (group B) and lubricants (group D). Number of digits displayed with API density values: DMA 5000 M: 5 DMA 4500 M: 4 DMA 4100 M: 4 Number of digits displayed with °API Gravity values: DMA 5000 M: 3 DMA 4500 M: 2 DMA 4100 M: 2	
°API Gravity 15 °C	API gravity converted to 15 °C.

Group: API Functions	
°API Gravity 20 °C	API gravity converted to 20 °C.
°API Gravity 29.5 °C	API gravity converted to 29.5 °C.
°API Gravity 60 °F	API gravity converted to 60 °F.
API Density 15 °C	Conversion of density at measuring temperature to density at 15 °C.
API Density 20 °C	Conversion of density at measuring temperature to density at 20 °C.
API Density 29.5 °C	Conversion of density at measuring temperature to density at 29.5 °C.
API Density 60 °F	Conversion of density at measuring temperature to density at 60 °F.
API Input Quantity	Selection of the input parameter for API calculations: Density, Density (not visc.-corr.) or a Special Adjustment.
API Product Group	Selection of the API product group for calculation of API gravity, density and specific gravity.
API Specific Gravity 15 °C	Conversion of density at measuring temperature to specific gravity at 15 °C.
API Specific Gravity 20 °C	Conversion of density at measuring temperature to specific gravity at 20 °C.
API Specific Gravity 29.5 °C	Conversion of density at measuring temperature to specific gravity at 29.5 °C.
API Specific Gravity 60 °F	Conversion of density at measuring temperature to specific gravity at 60 °F.

Group: Special Adjustments
Up to 5 special adjustments can be stored in the DMA Generation M (see Chapter 11.3.5).

Appendix G: List of Quick Settings Parameters

Parameter Type	Parameter Select	Description
Sample Name		Only in the "No Sample List" mode
Type	S (Standard)	To perform a standard measurement
	C (Check)	To perform one of the predefined checks. It is only possible to select a check which has been defined for the selected method before.
	MM (Multiple Measurement)	To perform 2 to 10 measurements of a single sample automatically.
	TS (Temperature Scan)	To perform a temperature scan.
Density Temperature		To set the temperature of the density measuring cell. Enter a value between -25 and 95 °C (or 90 °C).
Density Measurement finished by	Predetermination	default
	Equilibrium	
	for DMA 5000 M:	
	Equilibrium fast	
	Equilibrium medium	
	Equilibrium slow	
	None (use method default)	
Density Timeout		To set the timeout for the density measurement (between 30 and 3600 s; default 600 s).
Density FillingCheck™	Always active	default
	Not active	
	Active during measurement	
	None (use method default)	

Parameter Type	Parameter Select	Description
Density API Product Group	A - Crude oil	default
	B - Fuels	
	D - Lubes	
	None (use method default)	
Density API Input Quantity	Density	default
	Density (not visc. - corr.)	
	Special Adjustment	up to 5
	None (use method default)	
Density Canadian Excise Alcohol Table	Special Adjustment 1, …, 5	default
	None (use method default)	
User-defined data fields		If set as mandatory in the sample list settings.
User functions of the "Constant" type		If activated in the method settings.

Appendix H: Bar Codes for Assigning Methods

To generate a bar code for a method, you can use any bar code generator, e.g. http://barcode.tec-it.com.

- Use the format "MethodX" with "X" standing for the position number of the method in the method list.
- To view the position number, tap <Method>.

NOTICE
Please check the position number of your method after any changes in the method sequence, after deleting or hiding methods and after creating new methods.

The bar codes pictured below are type Code 128 (encodes all 128 ASCII characters).

Method1

Method6

Method2

Method7

Method3

Method8

Method4

Method9

Method5

Method10

Appendix I: Density Tables

Density of Air

At the temperature t in [°C] and the pressure p in [mbar] or [hPa] the density ρ of air in [g/cm³] is calculated using the following formula for an air humidity of 50 %:

$$\rho=(((0.34844*p-0.5*(0.252*t-2.0582))/(273.15+t)/1000))$$

The numbers are valid for a CO_2 content in air of 0.03 % by volume; the numbers change by ±1/19000 for every change in CO_2 volume content of ±0.0001.

Density of Air (-10 °C to +90 °C)[1]

Composition of dry air in [v/v]: 78.110 % N_2; 20.938 % O_2; 0.916 % Ar; 0.033 % CO_2; 0.002 % Ne

The table lists values of air with 50 % air humidity.

Meas. temp. in °C	Density in g/cm³ at the pressure in mbar (=hPa)							
	900	920	940	960	980	1000	1013.25	1050
-10	0.001200	0.001227	0.001253	0.001280	0.001306	0.001333	0.001350	0.001399
-5	0.001176	0.001202	0.001228	0.001254	0.001280	0.001306	0.001323	0.001371
0	0.001152	0.001177	0.001203	0.001228	0.001254	0.001279	0.001296	0.001343
5	0.001129	0.001154	0.001179	0.001204	0.001229	0.001254	0.001271	0.001317
10	0.001107	0.001131	0.001156	0.001181	0.001205	0.001230	0.001246	0.001291
15	0.001085	0.001110	0.001134	0.001158	0.001182	0.001206	0.001222	0.001267
20	0.001065	0.001088	0.001112	0.001136	0.001160	0.001184	0.001199	0.001243
25	0.001045	0.001068	0.001091	0.001115	0.001138	0.001162	0.001177	0.001220
30	0.001025	0.001048	0.001071	0.001094	0.001117	0.001140	0.001156	0.001198
35	0.001007	0.001029	0.001052	0.001075	0.001097	0.001120	0.001135	0.001176
40	0.000989	0.001011	0.001033	0.001055	0.001078	0.001100	0.001115	0.001156
45	0.000971	0.000993	0.001015	0.001037	0.001059	0.001081	0.001095	0.001135
50	0.000954	0.000976	0.000997	0.001019	0.001040	0.001062	0.001076	0.001116
55	0.000938	0.000959	0.000980	0.001001	0.001023	0.001044	0.001058	0.001097
60	0.000922	0.000943	0.000964	0.000984	0.001005	0.001026	0.001040	0.001079
65	0.000906	0.000927	0.000947	0.000968	0.000989	0.001009	0.001023	0.001061
70	0.000891	0.000911	0.000932	0.000952	0.000972	0.000993	0.001006	0.001043
75	0.000877	0.000897	0.000917	0.000937	0.000957	0.000977	0.000990	0.001027
80	0.000862	0.000882	0.000902	0.000922	0.000941	0.000961	0.000974	0.001010
85	0.000849	0.000868	0.000887	0.000907	0.000926	0.000946	0.000959	0.000995
90	0.000835	0.000854	0.000874	0.000893	0.000912	0.000931	0.000944	0.000979

1. Literature: F. Spieweck, H. Bettin: Review: Solid and liquid density determination tm 7/8 1992 p291

Density of Water (0 °C to 100 °C)[2]

T °C	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0	.999840	.999846	.999853	.999859	.999865	.999871	.999877	.999883	.999888	.999893
1	.999899	.999903	.999908	.999913	.999917	.999921	.999925	.999929	.999933	.999937
2	.999940	.999943	.999946	.999949	.999952	.999954	.999956	.999959	.999961	.999962
3	.999964	.999966	.999967	.999968	.999969	.999970	.999971	.999971	.999972	.999972
4	.999972	.999972	.999972	.999971	.999971	.999970	.999969	.999968	.999967	.999965
5	.999964	.999962	.999960	.999958	.999956	.999954	.999951	.999949	.999946	.999943
6	.999940	.999937	.999934	.999930	.999926	.999923	.999919	.999915	.999910	.999906
7	.999901	.999897	.999892	.999887	.999882	.999877	.999871	.999866	.999860	.999854
8	.999848	.999842	.999836	.999829	.999823	.999816	.999809	.999802	.999795	.999788
9	.999781	.999773	.999766	.999758	.999750	.999742	.999734	.999725	.999717	.999708
10	.999699	.999691	.999682	.999672	.999663	.999654	.999644	.999635	.999625	.999615
11	.999605	.999595	.999584	.999574	.999563	.999553	.999542	.999531	.999520	.999508
12	.999497	.999486	.999474	.999462	.999450	.999438	.999426	.999414	.999402	.999389
13	.999377	.999364	.999351	.999338	.999325	.999312	.999298	.999285	.999271	.999258
14	.999244	.999230	.999216	.999202	.999187	.999173	.999158	.999144	.999129	.999114
15	.999099	.999084	.999069	.999053	.999038	.999022	.999006	.998991	.998975	.998959
16	.998942	.998926	.998910	.998893	.998876	.998860	.998843	.998826	.998809	.998792
17	.998774	.998757	.998739	.998722	.998704	.998686	.998668	.998650	.998632	.998613
18	.998595	.998576	.998558	.998539	.998520	.998501	.998482	.998463	.998443	.998424
19	.998404	.998385	.998365	.998345	.998325	.998305	.998285	.998265	.998244	.998224
20	.998203	.998182	.998162	.998141	.998120	.998099	.998077	.998056	.998035	.998013
21	.997991	.997970	.997948	.997926	.997904	.997882	.997859	.997837	.997815	.997792
22	.997769	.997747	.997724	.997701	.997678	.997654	.997631	.997608	.997584	.997561
23	.997537	.997513	.997490	.997466	.997442	.997417	.997393	.997369	.997344	.997320
24	.997295	.997270	.997246	.997221	.997196	.997170	.997145	.997120	.997094	.997069
25	.997043	.997018	.996992	.996966	.996940	.996914	.996888	.996861	.996835	.996809
26	.996782	.996755	.996729	.996702	.996675	.996648	.996621	.996594	.996566	.996539
27	.996511	.996484	.996456	.996428	.996400	.996373	.996344	.996316	.996288	.996260
28	.996232	.996203	.996174	.996146	.996117	.996088	.996059	.996030	.996001	.995972
29	.995943	.995913	.995884	.995854	.995825	.995795	.995765	.995735	.995705	.995675
30	.995645	.995615	.995584	.995554	.995523	.995493	.995462	.995431	.995401	.995370
31	.995339	.995307	.995276	.995245	.995214	.995182	.995151	.995119	.995087	.995056
32	.995024	.994992	.994960	.994928	.994895	.994863	.994831	.994798	.994766	.994733
33	.994700	.994667	.994635	.994602	.994569	.994535	.994502	.994469	.994436	.994402
34	.994369	.994335	.994301	.994268	.994234	.994200	.994166	.994132	.994097	.994063
35	.994029	.993994	.993960	.993925	.993891	.993856	.993821	.993786	.993751	.993716

2. Literature: Spieweck, F. & Bettin, H.: Review: Solid and liquid density determination. Technisches Messen 59 (1992), pp. 285-292.

T °C	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
36	.993681	.993646	.993610	.993575	.993540	.993504	.993468	.993433	.993397	.993361
37	.993325	.993289	.993253	.993217	.993181	.993144	.993108	.993072	.993035	.992998
38	.992962	.992925	.992888	.992851	.992814	.992777	.992740	.992703	.992665	.992628
39	.992591	.992553	.992515	.992478	.992440	.992402	.992364	.992326	.992288	.992250
40	.992212	.992174	.992135	.992097	.992058	.992020	.991981	.991942	.991904	.991865
41	.991826	.991787	.991748	.991708	.991669	.991630	.991590	.991551	.991511	.991472
42	.991432	.991392	.991353	.991313	.991273	.991233	.991193	.991152	.991112	.991072
43	.991031	.990991	.990950	.990910	.990869	.990828	.990787	.990747	.990706	.990665
44	.990623	.990582	.990541	.990500	.990458	.990417	.990375	.990334	.990292	.990250
45	.990208	.990167	.990125	.990083	.990040	.989998	.989956	.989914	.989871	.989829
46	.989786	.989744	.989701	.989658	.989616	.989573	.989530	.989487	.989444	.989401
47	.989358	.989314	.989271	.989228	.989184	.989141	.989097	.989053	.989010	.988966
48	.988922	.988878	.988834	.988790	.988746	.988702	.988657	.988613	.988569	.988524
49	.988480	.988435	.988390	.988346	.988301	.988256	.988211	.988166	.988121	.988076
50	.988030	.987985	.987940	.987894	.987849	.987804	.987758	.987712	.987667	.987621
51	.987575	.987529	.987483	.987437	.987391	.987345	.987298	.987252	.987206	.987159
52	.987113	.987066	.987020	.986973	.986926	.986879	.986833	.986786	.986739	.986692
53	.986644	.986597	.986550	.986503	.986455	.986408	.986360	.986313	.986265	.986217
54	.986170	.986122	.986074	.986026	.985978	.985930	.985882	.985833	.985785	.985737
55	.985688	.985640	.985591	.985543	.985494	.985446	.985397	.985348	.985299	.985250
56	.985201	.985152	.985103	.985054	.985004	.984955	.984906	.984856	.984807	.984757
57	.984708	.984658	.984608	.984558	.984509	.984459	.984409	.984359	.984308	.984258
58	.984208	.984158	.984107	.984057	.984007	.983956	.983905	.983855	.983804	.983753
59	.983702	.983652	.983601	.983550	.983499	.983448	.983396	.983345	.983294	.983242
60	.983191	.983140	.983088	.983036	.982985	.982933	.982881	.982829	.982778	.982726
61	.982674	.982621	.982569	.982517	.982465	.982413	.982360	.982308	.982255	.982203
62	.982150	.982098	.982045	.981992	.981939	.981886	.981834	.981780	.981727	.981674
63	.981621	.981568	.981515	.981461	.981408	.981354	.981301	.981247	.981194	.981140
64	.981086	.981032	.980979	.980925	.980871	.980817	.980763	.980708	.980654	.980600
65	.980546	.980491	.980437	.980382	.980328	.980273	.980219	.980164	.980109	.980054
66	.980000	.979945	.979890	.979835	.979780	.979724	.979669	.979614	.979559	.979503
67	.979448	.979392	.979337	.979281	.979226	.979170	.979114	.979058	.979002	.978946
68	.978890	.978834	.978778	.978722	.978666	.978610	.978553	.978497	.978441	.978384
69	.978328	.978271	.978214	.978158	.978101	.978044	.977987	.977930	.977874	.977816
70	.977759	.977702	.977645	.977588	.977531	.977473	.977416	.977358	.977301	.977243
71	.977186	.977128	.977070	.977012	.976955	.976897	.976839	.976781	.976723	.976665
72	.976607	.976548	.976490	.976432	.976374	.976315	.976257	.976198	.976140	.976081
73	.976022	.975963	.975905	.975846	.975787	.975728	.975669	.975610	.975551	.975492
74	.975432	.975373	.975314	.975255	.975195	.975136	.975076	.975017	.974957	.974897
75	974838	.974778	.974718	.974658	.974598	.974538	.974478	.974418	.974358	.974298
76	.974237	.974177	.974117	.974056	.973996	.973935	.973875	.973814	.973753	.973693

T °C	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
77	.973632	.973571	.973510	.973449	.973388	.973327	.973266	.973205	.973144	.973083
78	.973021	.972960	.972899	.972837	.972776	.972714	.972653	.972591	.972529	.972468
79	.972406	.972344	.972282	.972220	.972158	.972096	.972034	.971972	.971910	.971847
80	.971785	.971723	.971660	.971598	.971535	.971473	.971410	.971348	.971285	.971222
81	.971159	.971096	.971034	.970971	.970908	.970844	.970781	.970718	.970655	.970592
82	.970528	.970465	.970402	.970338	.970275	.970211	.970148	.970084	.970020	.969956
83	.969893	.969829	.969765	.969701	.969637	.969573	.969509	.969445	.969380	.969316
84	.969252	.969188	.969123	.969059	.968994	.968930	.968865	.968800	.968736	.968671
85	.968606	.968541	.968477	.968412	.968347	.968282	.968216	.968151	.968086	.968021
86	.967956	.967890	.967825	.967760	.967694	.967629	.967563	.967497	.967432	.967366
87	.967300	.967234	.967169	.967103	.967037	.966971	.966905	.966838	.966772	.966706
88	.966640	.966574	.966507	.966441	.966374	.966308	.966241	.966175	.966108	.966042
89	.965975	.965908	.965841	.965774	.965707	.965640	.965573	.965506	.965439	.965372
90	.965305	.965238	.965170	.965103	.965036	.964968	.964901	.964833	.964765	.964698
91	.964630	.964562	.964495	.964427	.964359	.964291	.964223	.964155	.964087	.964019
92	.963951	.963882	.963814	.963746	.963677	.963609	.963541	.963472	.963404	.963335
93	.963266	.963198	.963129	.963060	.962991	.962922	.962854	.962785	.962716	.962646
94	.962577	.962508	.962439	.962370	.962300	.962231	.962162	.962092	.962023	.961953
95	.961884	.961814	.961744	.961675	.961605	.961535	.961465	.961395	.961325	.961255
96	.961185	.961115	.961045	.960975	.960905	.960834	.960764	.960694	.960623	.960553
97	.960482	.960412	.960341	.960271	.960200	.960129	.960058	.959988	.959917	.959846
98	.959775	.959704	.959633	.959562	.959490	.959419	.959348	.959277	.959205	.959134
99	.959062	.958991	.958920	.958848	.958776	.958705	.958633	.958561	.958489	.958418
100	.958346	.958273	.958201	.958129	.958057	.957985	.957913	.957840	.957768	.957696

Appendix J: Firmware Versions

Firmware version	Date of release	Document number	Comments
V1.00	18.06.2008	C76IB01A	First released version.
V1.10	14.08.2008	C76IB01B	Users with administrator rights can update the Operating System and adjust the camera position.
V1.52	27.02.2009	C76IB01C	• Limits can be defined for any output quantity • 10 sample lists available • Statistics (minimum, maximum, standard deviation, mean) • 5 special adjustments available • LIMS support • Custom checks can be defined • Check history for the last 100 checks • 50 methods can be defined • Graphs can be displayed/printed: KB graph, calculator • Selective backup/restore implemented • Temperature scan (DMA 5000 M only)
V1.60	19.08.2009	C76IB01D C76IB01E	• The sequence of items in the data browser, favorites list and result output can be changed • Screen saver implemented • Feedback beep after measurement can be selected • Single results can be deleted • Audit Trail: automatic logoff after 60 minutes without user interaction • RS-232 connection with external PC possible • Changes of method settings limited to users with administrator rights • Extended support of external keyboard
V1.70	15.01.2010	C76IB01F	• Group calculator • GUI performance improved • Audit trail: password rules • Temperature scan for all instruments • Mandatory data fields • Installing of language pack • Three new RS-232 commands according to DMA classic instruments • More detailed information in system information • Live raw data can be printed • Screen saver is disabled by interface commands

Firmware version	Date of release	Document number	Comments
V2.00	10.09.2010	C76IB003EN-A	• GUI performance improved • Data browser filter: only users and methods used are available • More detailed information about firmware module state during startup (new initialization screen instead of online screen) • Safe mode operation after firmware errors • Sample list: ring buffer for 200 sample list entries. Sample list entries older than 24 hours are automatically removed • Data memory can be set as ring buffer if Audit Trail is deactivated • <Monitor> button to unfreeze the screen moved to the quick access area • Allowed minimum step size in temperature scans depends now on the equilibrium setting of the density module • Keyboard and bar code settings: the sample list can be edited with a bar code reader (tab key as terminator) • <Redo> option after adjustments available • New air pump setting: Automatic stop when the density value is stable • Audit Trail stores more detailed and structured information on changes to the system • New RS-232 commands: "set temperature" and "help" • Printing a single sample on a list report is not supported any more • Current API product group for API calculation is now displayed in the calculator
V2.10	22.12.2010	C76IB003EN-B	New multiple measurements menu.

Firmware version	Date of release	Document number	Comments
V2.20	12.09.2011	C76IB003EN-C	• New system security settings implemented: different security levels, electronic signature, auto logoff and password expiry • "Audit Trail" menu now in the "System Security" menu • Quick settings implemented for convenient change of measurement settings • "No Sample List" mode available • Methods can be hidden and arranged • New "Constant" user function added • Printing support for adjustments added • Camera images during adjustment/check procedure added • PDF print reports and Excel exports optimized • For instruments from DCB version 1.000.009: Temperature range extended up to 95 °C • Support of CAN bar code readers • Hardware redesign: SD card is not used anymore • Show current method as postfix • Standardized output for the RS232 report • Prefill of widgets concerning the display layout after switching to another layout • Updating UI firmware, OS image and firmware modules at once without user confirmation upon every step (if all firmware modules are attached during the update) • Include adjustment data in backup/restore • Service Reminder • Possibility to activate FillingWarning only during measurement • Configuration of log files
		C76IB003EN-D	• Remark added to the instruction manual
V2.21	13.01.2012	C76IB003EN-E	• Supports combination with Abbemat Performance and Abbemat Peformance Plus refractometers • Supports combination with Lovis ME rolling-ball viscometer

Appendix K: Declaration of Conformity

CE Declaration of Conformity

Anton Paar

Anton Paar GmbH hereby declares that the product listed below in the version offered for sale meets all the basic requirements of the applicable sections of the relevant EU directives in design and type.

This declaration will be deemed invalid should any unauthorized modifications be made to the product. Follow the information given in the instruction manual when setting up and operating the instrument.

Product designation:	**DMA 4100 M LABORATORY DENSITY METER** **DMA 4500 M LABORATORY DENSITY METER** **DMA 5000 M LABORATORY DENSITY METER**
Model:	**DMA 4100 M** **DMA 4500 M** **DMA 5000 M**
Manufacturer:	**Anton Paar GmbH**

The product meets the requirements of the following directives:

- **Electromagnetic Compatibility 2004/108/EC**

  Applied standards:

EN 61326-1:2006	Electrical equipment for measurement, control and laboratory use - EMC requirements - Part 1: General requirements

The product is classified as a class B equipment and is intended for the use in industrial area.

- **Low Voltage Directive 2006/95/EC**

  Applied standards:

EN 61010-1:2001	Safety requirements for electrical equipment for measurement, control and laboratory use Part 1: General requirements
IEC 61010-2-010:2003	Safety requirements for electrical equipment for measurement, control, and laboratory use – Part 2-010: Particular requirements for laboratory equipment for the heating of materials

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Last modification 2008-02-21
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C76 DMA 4500M CE - Declaration A.doc
Page 1 of 1

Appendix L: Menu Tree

The menu tree shows which parts of the menu are accessible for users with administrator, manager or operator rights using the following colors:

Administrator
Administrator, Manager
Administrator, Manager, Operator

Checks/Adjustments	Checks		
	Air/Water Adjustment		
	Other Adjustments	Density Module	Air/Water Adjustment
			Temperature Range Adjustment
			High Density/Viscosity Adjustment[a]
			Atmospheric Pressure Sensor Adjustment
			Special Adjustments
			Reset To Factory Adjustment
Data Memory	Measured Data		
	Statistic		
	Delete Measured Data		
	Audit Trail		
	Check/SOP Data		
	Delete Audit Trail		
	Adjustment Data	Density Module	Density Adjustment
			Temperature Adjustment
			Density Adjustment KB Graph
			Special Adjustment
Methods	Method Settings	Density (Current Method)	Activate Modules / Constants[b]
			Density Module
			Display Layout
			Result Output
			Limits
			Multiple Measurement Settings
			Formula Parameters
			Quick Settings Management
		Density (not visc.-corr.)	
		°Brix	
		Ethanol (% w/w OIML-ITS90)	
		Ethanol (% v/v OIML-ITS90)	
		Ethanol (°Proof 60 °F AOAC)	
		Crude Oil (API)	
		Fuel Oil (API)	
		Lubricants (API)	
		Sulfuric Acid (% w/w)	
	Method Management		
	Method Visibility		

Setup	Measuring System Settings	Sample List	Sample List / Sample Settings
			User-defined Data Fields
			Sample List Warnings
			Mandatory Data Fields
		Camera[c]	
		Air Pump	
	Control Panel	Date and Time	
		Regional Settings	
		Input Units	
		Printer Management	
		Network	
		Instrument Name and Location	
		Screen Saver	
		Feedback Beeps	
		Calibrate Touch Screen	
		Calibrate External Touch Screen	
		Keyboard and Bar Code Settings	
		Advanced Camera Settings[c]	
	User Management[d]		
	System Security	Security Level	
		Audit Trail	
		Electronic Signature	
		Logon Settings	
		Increased security	
	Printout Settings	Automatic Printout	
		Report Management	
		Select Logos	
		Import Logos	
		Name and Address	
	Favorites Management		
	Data Browser Settings		
	Expert Settings	User Function Management	
		Calculator	
		Group Calculator	
		Check Management	
		Data Memory Settings	
Service	Backup Instrument Settings		
	Restore Instrument Settings		
	Update	User Interface Firmware	
		Module Firmware	
		Install Language Pack	
		Logging Configuration	
	System Information		

Service	Live Raw Data	DMA Density
		Calculations
		DCB - Air Pump
		DMA Density - Air Pressure
		DCB - Environment
		DCB - CAN Connector

a. DMA 5000 M only
b. Only if a "Constant" user function was created and/or if a module is connected
c. DMA 4500 M/DMA 5000 M only
d. Users of any user group may change their own password

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